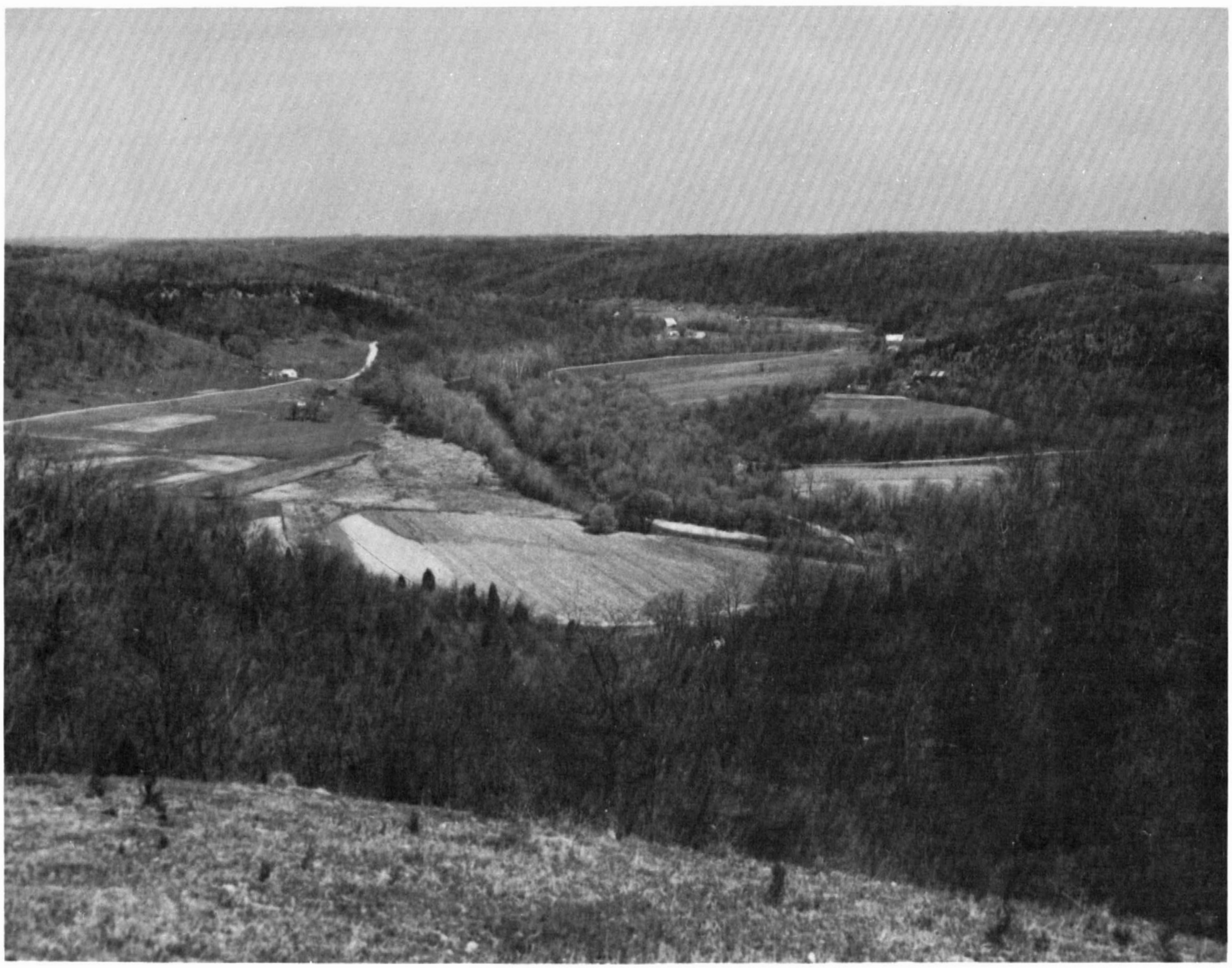
United States
Department of
Agriculture

Soil
Conservation
Service

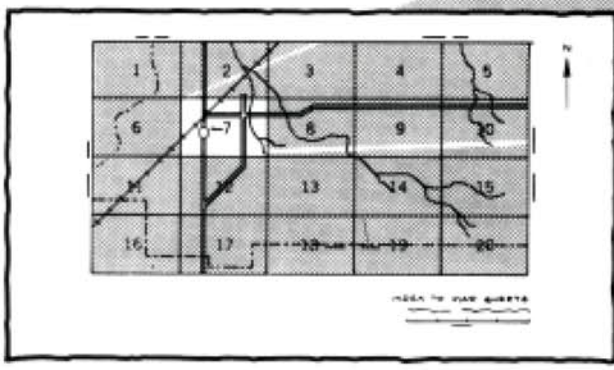
In cooperation with
Purdue University
Agricultural Experiment
Station and
Indiana Department of
Natural Resources,
Soil and Water
Conservation Committee

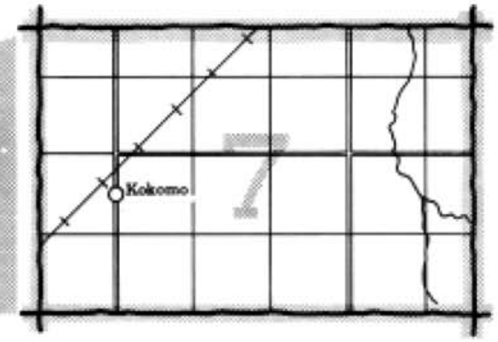
Soil Survey of Jefferson County Indiana



HOW TO USE

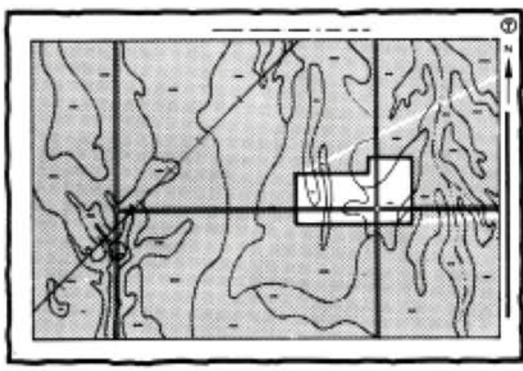
1. Locate your area of interest on the "Index to Map Sheets"

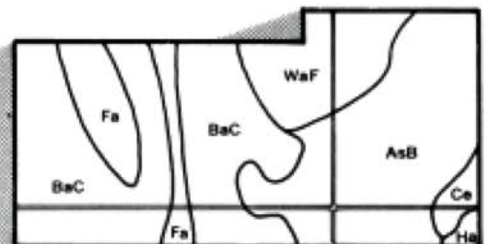




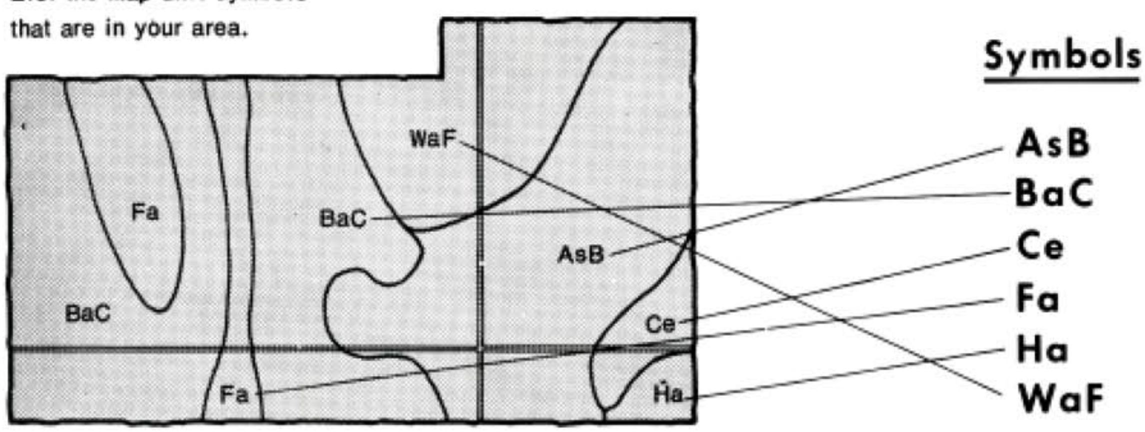
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



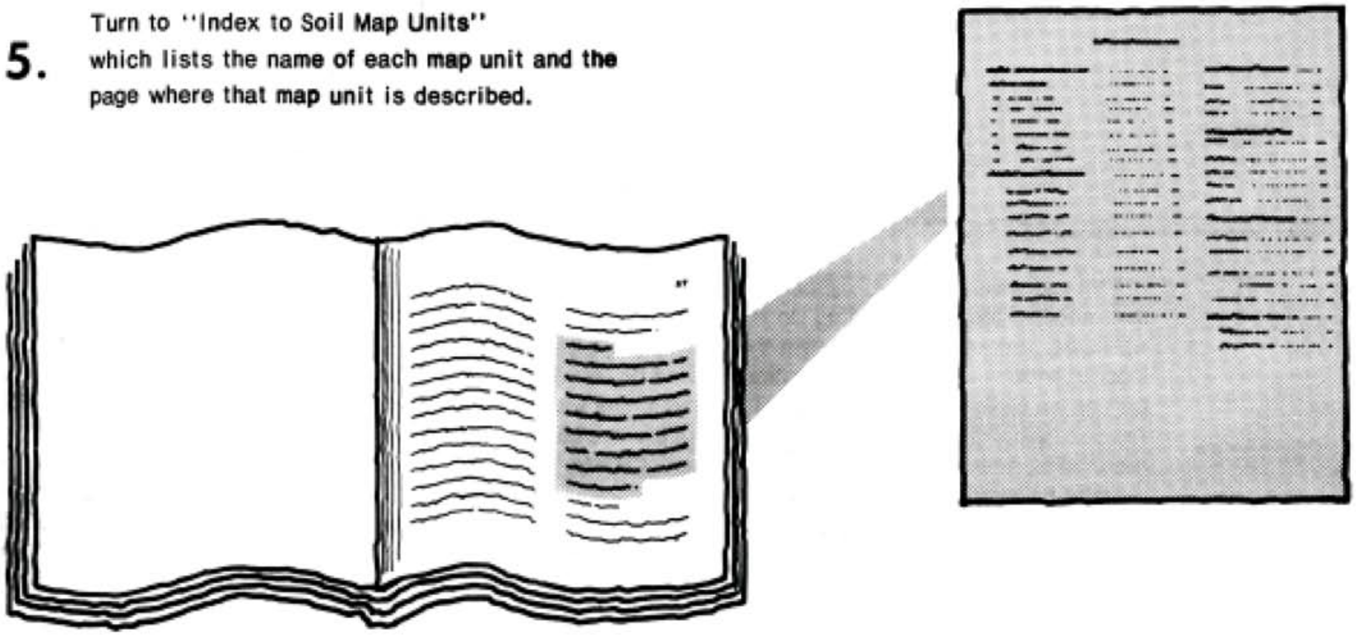


4. List the map unit symbols that are in your area.

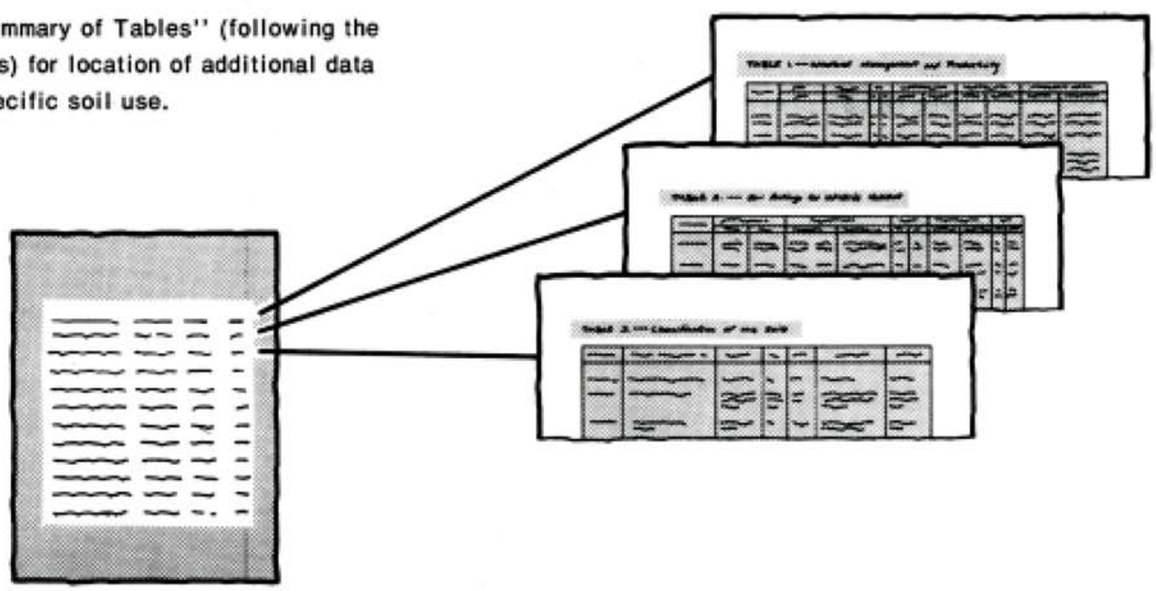


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1979. Soil names and descriptions were approved in 1982. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1980. This survey was made cooperatively by the Soil Conservation Service; the Purdue University Agricultural Experiment Station; and the Indiana Department of Natural Resources, Soil and Water Conservation Committee. It is part of the technical assistance furnished to the Jefferson County Soil and Water Conservation District. Financial assistance was made available by the Board of County Commissioners of Jefferson County.

Cover: Strongly dissected Eden soils on uplands surrounding Huntington and Wirt soils on bottom land.

Contents

Soil Series

Issued May 1985

Index to Map Units

Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Jefferson County, Indiana. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Robert L Eddleman

Robert L. Eddleman
State Conservationist
Soil Conservation Service

Location of Jefferson County in Indiana.

Soil Survey of
Jefferson County, Indiana

By Allan K. Nickell, Soil Conservation Service

Fieldwork by Allan K. Nickell, Gary Hamilton, and Gary R. Struben,
Soil Conservation Service, and Thomas R. Villars and Roger A. Kolesar,
Indiana Department of Natural Resources

United States Department of Agriculture, Soil Conservation Service,
in cooperation with
Purdue University Agricultural Experiment Station and
Indiana Department of Natural Resources,
Soil and Water Conservation Committee

JEFFERSON COUNTY is in the southeastern part of Indiana (see map on facing page). It has an area of about 234,240 acres, or 366 square miles. It extends about 22.5 miles from north to south and 26 miles from east to west. Madison, which is along the Ohio River, is the county seat.

General Nature of the County

This section gives general information about the physical and cultural features of Jefferson County. It describes the history and development; climate; physiography, relief, and drainage; water supply; business, industry, and transportation facilities; trends in population and land use; and farming.

History and Development

The early inhabitants of the area now known as Jefferson County were probably nomadic hunters. Arrowheads and other artifacts found in the area hint of more recent Indian inhabitants.

The first log cabin was built in 1808, in the area that later became Madison. Settlers came into the region from Kentucky and from the northeast down the Ohio River. The area officially became Jefferson County in 1811. The original county included parts of surrounding Jennings, Ripley, Scott, and Switzerland Counties.

Madison became a town in 1809 and was incorporated as a city in 1838. It flourished during the period 1830 to 1860, when it was a major political, cultural, and economic center. Currently, the entire downtown area is on the National Register of Historic Places.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Jefferson County is cold in winter and quite hot in summer. Winter precipitation, which frequently falls as snow, results in a good accumulation of soil moisture by spring and minimizes drought during summer on most soils. The normal annual precipitation is adequate for all of the crops that are suited to the temperature and the length of the growing season.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Madison in the period 1951 to 1976. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 35 degrees F, and the average daily minimum temperature is 26 degrees. The lowest temperature on record, which occurred at Madison on February 2, 1951, is -12 degrees. In summer the average temperature is 76 degrees, and the average daily maximum temperature is 87 degrees. The highest recorded temperature, which occurred on July 15, 1954, is 108 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing

degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is nearly 42 inches. Of this, 22 inches, or more than 50 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 18 inches. The heaviest 1-day rainfall during the period of record was 4 inches at Madison on June 23, 1960. Thunderstorms occur on about 50 days each year, and most occur in summer. Tornadoes and severe thunderstorms strike occasionally. These storms usually are local in extent and of short duration and cause damage in scattered small areas.

The average seasonal snowfall is about 13 inches. The greatest snow depth at any one time during the period of record was 12 inches. On the average, 1 day of the year has at least 1 inch of snow on the ground.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 40 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 10 miles per hour, in spring.

Physiography, Relief, and Drainage

Relief in Jefferson County is influenced by the two major waterways—the Ohio River and the Muscatatuck River. The Ohio River watershed, in the eastern one-third of the county, is very dissected and is characterized by narrow, sloping ridges and steep hillsides. Many terraces are along the river. Low lying areas in Madison and Brooksburg, both near the river, are occasionally flooded. The Muskatatuck River watershed, in the western two-thirds of the county, generally is characterized by broad, nearly level ridges and moderately sloping hillsides.

The major tributary of the Ohio River in Jefferson County is Indian-Kentuck Creek, which drains the eastern one-third of the county. It meanders through a broad valley that has many terraces. Numerous smaller tributaries, such as the West Fork and Wilson Fork, in turn, flow into it. Other tributaries of the Ohio River include Crooked Creek, near Madison, and Big Saluda Creek. The Muscatatuck River flows for a few miles through the northwestern part of the county. Big Creek is its main tributary in the county.

The highest point in the county, which is near the northeast corner, is 970 feet above sea level. The lowest point, which is in an area along the Ohio River, is about 425 feet above sea level.

Water Supply

Public or private utilities provide service to three-fourths of the households in Jefferson County. Nearly all of this water is pumped from deep wells in the sand and gravel deposited in the valley of the Ohio River. It is stored in tanks or reservoirs and distributed throughout the county by public rural waterlines. The Stucker Fork Conservancy District supplies water to a small part of western Jefferson County. It obtains its water from the Muscatatuck River in Scott County and from Hardy Lake, a Department of Natural Resources facility in Scott and Jefferson Counties.

In areas where it is not available through public waterlines, water is obtained from dug wells, drilled wells, springs, cisterns, ponds, creeks, or rivers. Individual wells serve about one-fifth of the households in the county.

The best potential water source for wells is the Silurian dolomitic limestone and shaly bedrock in the central part of the county. The Devonian New Albany shale in the western part of the county generally does not bear water. Wells in these deposits commonly contain saline or sulfuric water, if any water at all.

In many areas the flow from springs is not sufficient for both domestic and farm uses, and when rainfall is low, dug wells and cisterns may become dry. As a result, small ponds and reservoirs are used to provide supplemental water. Many farm ponds and lakes have been built to meet farm needs.

Business, Industry, and Transportation Facilities

Businesses within Jefferson County employ 83 percent of the working population of the county and some from the surrounding counties. About 30 percent of the work force is engaged in manufacturing and 18 percent in professional or other services.

Many industries are located in Madison. These include manufacturers of women's shoes, work clothing, automotive safety equipment, hydraulic lifts, heating and metal products, electric motors, and road construction machinery.

Madison is the major tobacco market in southern Indiana. A coal-fired electrical power plant is 1 mile west of downtown Madison, and a nuclear power plant is currently under construction in the southern part of Jefferson County.

The main roads in Jefferson County are State Roads 3, 7, 56, and 62, and U.S. 421. All of these pass through Madison except State Road 3. Interstate 65 is 8 miles west of the western county boundary, in adjacent Scott County. The county is served by one public airport and one railroad. The Ohio River bridge in Madison was, until recent years, the only bridge across the Ohio River

between Cincinnati and Louisville. Most barge lines serve Madison.

Trends in Population and Land Use

In 1980, Jefferson County had a population of about 30,400 and a population density of 83 people per square mile. The population increased only 12.2 percent between 1960 and 1970 but is anticipated to be about 34,000 by the year 2000 *(9)*.

The acreage used for agricultural crops and woodland has been gradually decreasing as more and more land is developed for other uses. In 1967, about 28,898 acres was used for purposes not related to agriculture or forestry *(5)*. Of this acreage, about 9,000 acres was urban and the rest was used for roads, water areas, gravel pits, quarries, and other types of development, such as a military installation and a state park *(4)*. This acreage is expected to increase at the rate of about 210 acres per year over the next 20 years.

Farming

The number of farms in the county increased from 1,046 in 1978 to 1,055 in 1982 *(8)*. The average size of the farms decreased from 135 acres in 1978 to 134 acres in 1982. During this 4-year period, the number of farm owners farming full time decreased from 453 to 401, the number of farm owners farming part time increased from about 210 to about 259, and the number of tenant farmers increased from 78 to 79. The number of livestock, especially hogs, generally decreased during this period, but the number of sheep increased.

About 60 percent of the acreage in the county is actively farmed. Corn and soybeans are the main crops. Wheat and tobacco are next in importance. About 75 percent of the farmers in the county derive much of their income from small acreages of tobacco. A major part of the total acreage is used for hay and pasture. Most hayfields and pastures support tall fescue and red clover. Some alfalfa also is grown. About 100 acres in the county is used for commercial apple and peach orchards. Vegetable crops are grown commercially in numerous small areas. These crops include sweet corn, snap beans, potatoes, tomatoes, pumpkins, and some berries.

Farming in the county consists mainly of grain farming and the raising of livestock, chiefly beef cattle and hogs. Some chickens, dairy cattle, and sheep are also raised. The areas used for grain farming are on the river bottoms and terraces throughout the county and on the nearly level and gently sloping uplands in the western two-thirds of the county. The uplands in the eastern one-third of the county and the sloping to steep uplands in other parts of the county are used primarily for pasture or woodland.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The soils in the survey area vary widely in their potential for major land uses. Table 4 shows the extent of the associations shown on the general soil map. It lists the potential of each, in relation to that of the other associations, for major land uses and shows soil properties that limit use. Soil potential ratings are based on the practices commonly used in the survey area to overcome soil limitations. These ratings reflect the ease of overcoming the limitations. They also reflect the problems that will persist even if such practices are used.

Each association is rated for *cultivated crops, specialty crops, woodland, urban uses,* and *recreation areas.* Cultivated crops are those grown extensively in the survey area. Specialty crops are the vegetables and fruits that generally require intensive management. Woodland refers to areas of native or introduced trees. Urban uses include residential, commercial, and industrial developments. Intensive recreation areas are campsites, picnic areas, ballfields, and other areas that are subject to heavy foot traffic. Extensive recreation areas are those used for nature study and as wilderness.

The names, descriptions, and delineations of the soils identified on the general soil map of this county do not always agree or join fully with those of the soils identified on the maps of adjoining counties published at an earlier date. For example, the Cobbsfork soils in this survey were correlated as Clermont soils in earlier surveys. Some differences are the result of changes in concepts of soil series. Other differences result from variations in the extent of the soils. Others are the result of variations in the slope range allowed in the map units.

Soil Descriptions

1. Wirt-Haymond

Deep, nearly level, well drained soils formed in silty and loamy alluvium; on bottom land

This map unit is on bottom land along the major streams in the northwestern part of the county. Areas are narrow and elongated. Slopes range from 0 to 2 percent.

This map unit makes up about 2 percent of the survey area. It is about 42 percent Wirt soils, 24 percent Haymond soils, and 34 percent soils of minor extent.

Typically, the Wirt soils have a dark brown silt loam surface layer about 8 inches thick. The subsoil is dark brown and dark yellowish brown, friable silt loam and loam. The substratum is dark yellowish brown, friable sandy loam and cherty sandy loam.

Typically, the Haymond soils have a dark brown silt loam surface layer about 10 inches thick. The subsoil is dark yellowish brown and dark brown, friable silt loam. The substratum is dark yellowish brown and dark brown silt loam.

The minor soils in the map unit are the moderately well drained Pekin soils and rarely flooded Elkinsville soils on terraces and the gently sloping and moderately sloping Negley soils on valley trains. Pekin soils have a fragipan in the subsoil.

This map unit is used mainly for cultivated crops, chiefly corn, soybeans, and small grain. It is suited to these crops. The major hazard is flooding.

The flooding is such a severe hazard that this map unit generally is unsuited to urban uses. Overcoming this hazard is difficult. Suitability is only fair for the more intensive types of recreational development because of the flooding.

2. Huntington-Dearborn-Elkinsville

Deep, nearly level and gently sloping, well drained soils formed in alluvium or in silty and loamy material; on bottom land and terraces

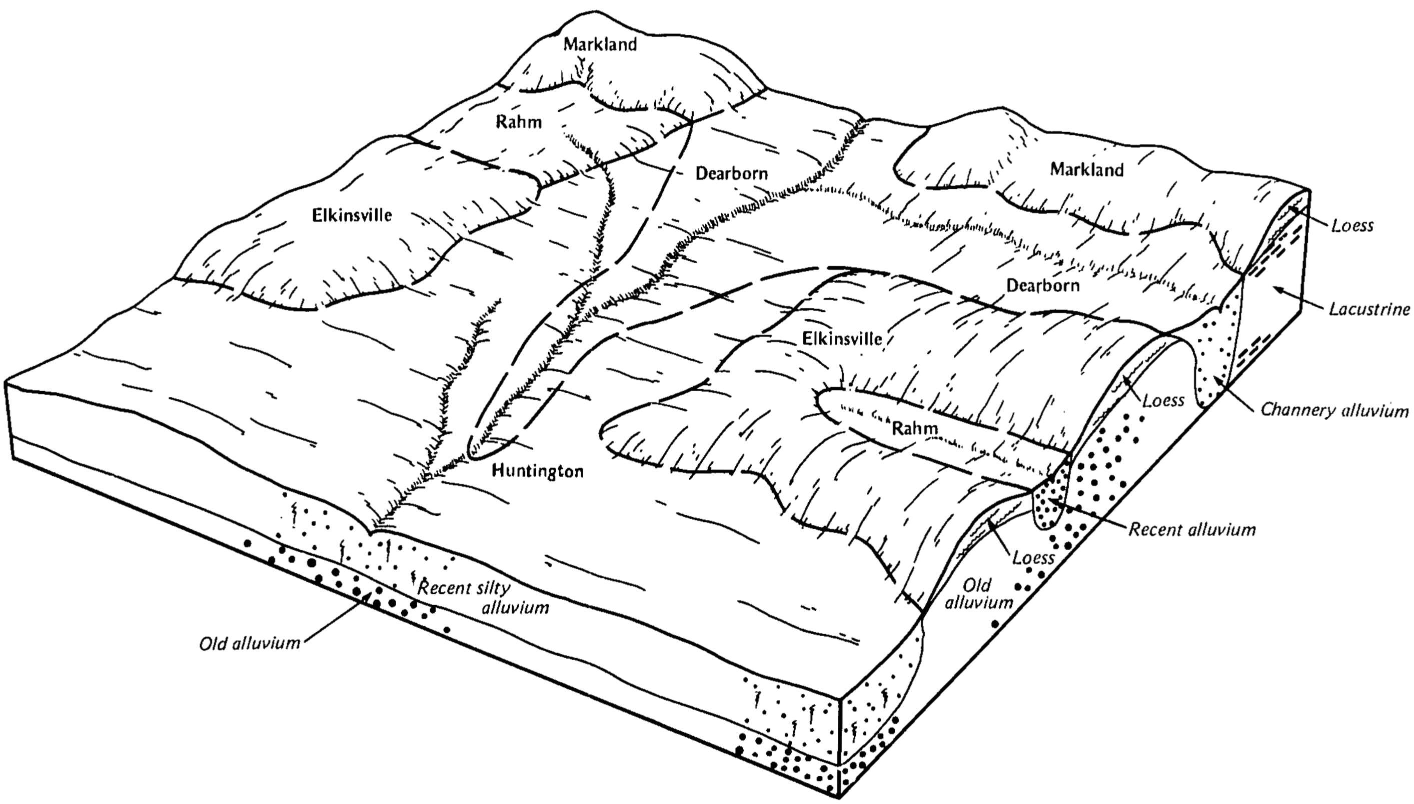


Figure 1.—Pattern of soils and parent material in the Huntington-Dearborn-Elkinsville map unit.

This map unit is on bottom land and terraces along the Ohio River and some of its tributaries. Slopes range from 0 to 8 percent.

This map unit makes up about 4 percent of the survey area. It is about 29 percent Huntington soils, 28 percent Dearborn soils, 18 percent Elkinsville soils, and 25 percent soils of minor extent (fig. 1).

The nearly level Huntington soils are on bottom land along the Ohio River and its larger tributaries. Typically, they have a dark brown silt loam surface layer about 3 inches thick and a dark brown silt loam subsurface layer about 14 inches thick. The subsoil is dark brown and dark yellowish brown, firm silty clay loam. The substratum is yellowish brown, mottled, firm silty clay loam.

The nearly level Dearborn soils are on toe slopes and bottom land adjacent to rapidly flowing streams. Typically, they have a dark brown channery silt loam surface layer about 11 inches thick. The subsoil is dark brown, loose extremely channery coarse loamy sand in the upper part and dark brown, friable channery loam in the lower part. The substratum is yellowish brown extremely channery coarse sandy loam in the upper part and yellowish brown extremely flaggy loamy sand in the lower part.

The nearly level and gently sloping Elkinsville soils are on broad terraces along the Ohio River. Typically, they have a dark brown silt loam surface layer about 8 inches thick. The subsoil is dark yellowish brown, friable silt loam in the upper part and yellowish brown, firm silty clay loam and friable silt loam and loam in the lower part. The substratum is yellowish brown, friable stratified loam and sandy loam.

The minor soils in the map unit are the somewhat poorly drained Rahm soils on high bottoms and low terraces, the moderately well drained and well drained Markland soils on lacustrine terraces, and the moderately dark Wirt soils on bottom land.

This map unit is used mainly for cultivated crops, pasture, and urban development. The main crops are corn, soybeans, and small grain. The main hazards are flooding on the bottom land and erosion in the more sloping areas on terraces.

This map unit is suited to cultivated crops and to pasture. It generally is unsuited to urban uses because the flooding on the bottom land is a severe hazard.

Overcoming this hazard is difficult. The suitability of the more sloping soils on terraces for pasture is good, but measures that control erosion are needed. Suitability is good for the more intensive types of recreational development.

3. Cobbsfork-Avonburg

Deep, nearly level and gently sloping, poorly drained and somewhat poorly drained soils formed in a thin mantle of loess and in the underlying glacial drift; on uplands

This map unit is on upland glacial drift plains that are characterized by smooth topography. These plains are at the highest elevation in the county. Areas are relatively large. Slopes range from 0 to 4 percent.

This map unit makes up about 32 percent of the survey area. It is about 47 percent Cobbsfork soils, 28 percent Avonburg soils, and 25 percent soils of minor extent (fig. 2).

The nearly level, poorly drained Cobbsfork soils have a seasonal high water table and are on the broadest tabular divides, where the glacial drift is thickest. Typically, they have a grayish brown silt loam surface layer about 6 inches thick. The subsurface layer also is grayish brown silt loam about 6 inches thick. The subsoil is light gray and light brownish gray, mottled silt loam in the upper part; light brownish gray, mottled, firm silt loam in the next part; and yellowish brown, mottled silt loam and strong brown clay loam in the lower part.

The nearly level and gently sloping, somewhat poorly drained Avonburg soils have a seasonal high water table and are on relatively broad tabular divides and on the upper back slopes. They have a very slowly permeable fragipan in the subsoil. Typically, they have a dark grayish brown silt loam surface layer about 10 inches thick. The subsoil is yellowish brown, mottled, friable silt loam and light brownish gray, mottled, friable silty clay loam in the upper part; a light brownish gray, mottled,

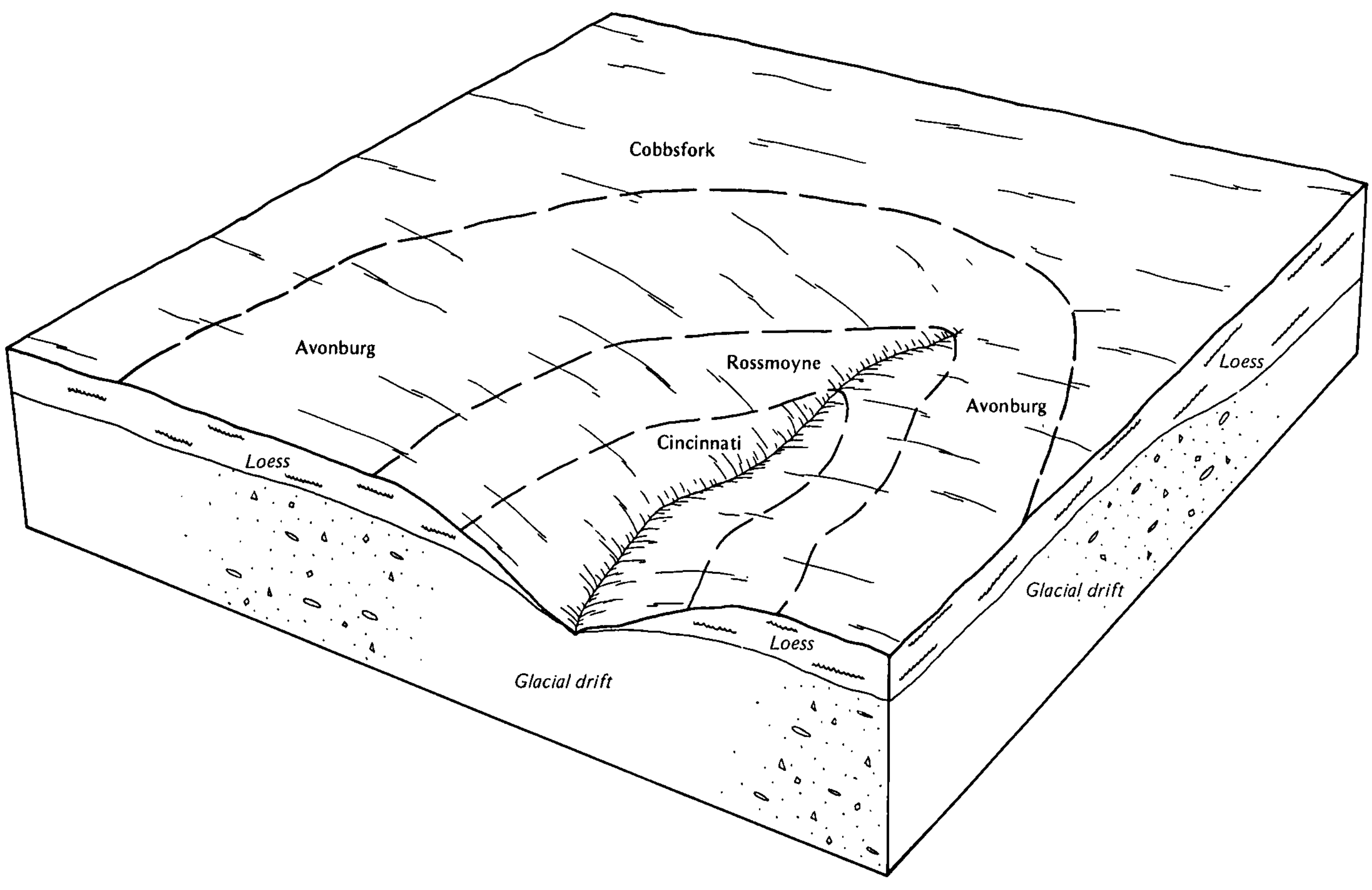


Figure 2.—Pattern of soils and parent material in the Cobbsfork-Avonburg map unit.

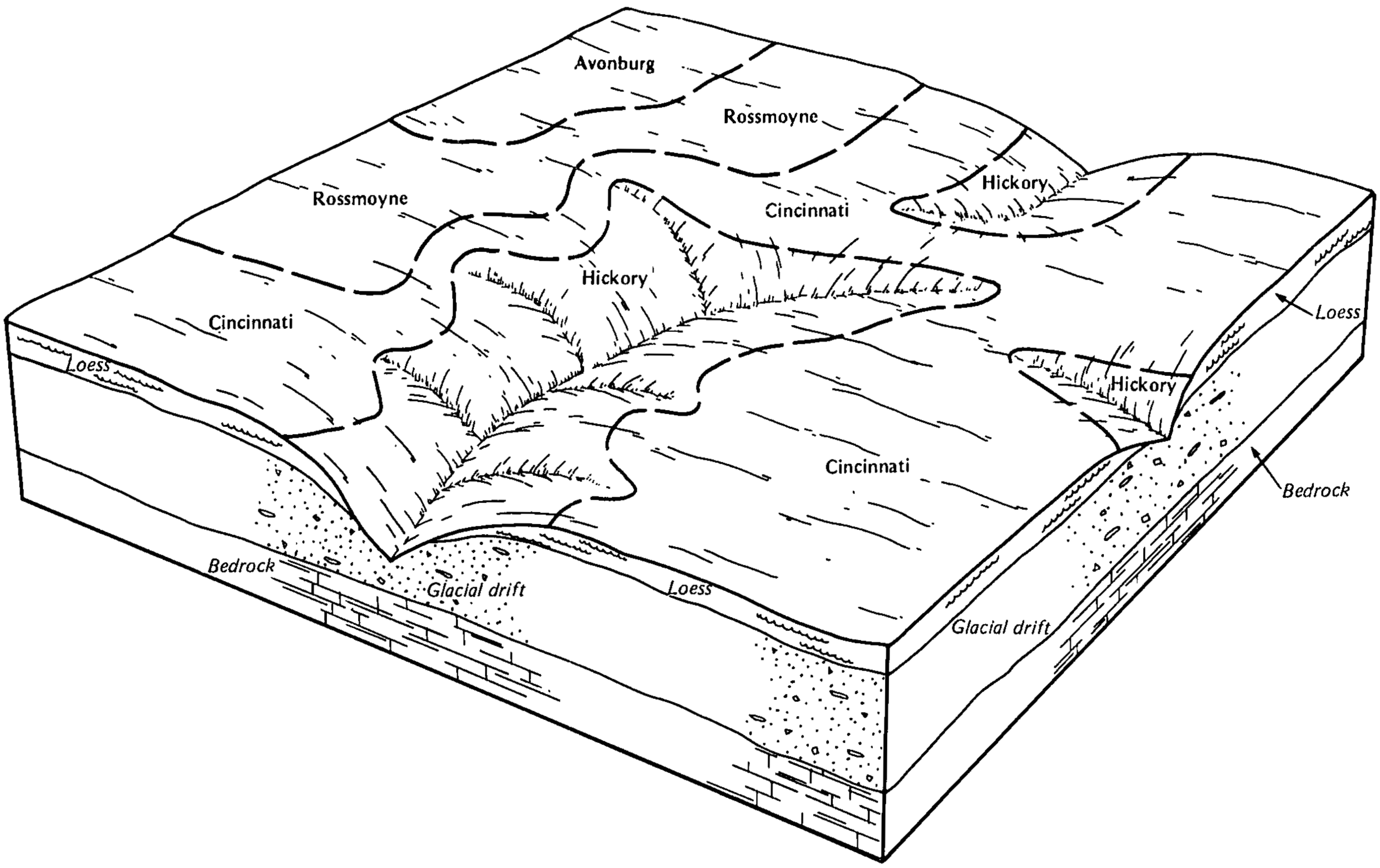


Figure 3.—Pattern of soils and parent material in the Cincinnati-Rossmoyne-Hickory map unit.

very firm silt loam fragipan in the next part; and light brownish gray, mottled, friable silt loam in the lower part.

The minor soils in the map unit are the moderately well drained Rossmoyne soils on summits, shoulder slopes, and the upper back slopes and the well drained Cincinnati soils on summits, shoulder slopes, and back slopes.

This map unit is used mainly for cultivated crops, but some areas are used for pasture or remain in woodland. In most of the cultivated areas, a surface drainage system has been installed. The main crops are corn, soybeans, and small grain. The wetness is the major limitation affecting farming and most other uses.

This map unit is suited to cultivated crops, but the wetness is a limitation. The wetness is such a severe limitation that the unit generally is unsuited to urban uses. Overcoming this limitation is difficult. Adequate drainage systems should be installed if areas of this unit are used for urban development. Suitability is poor for the more intensive types of recreational development because of the wetness.

4. Cincinnati-Rossmoyne-Hickory

Deep, nearly level to very steep, well drained and moderately well drained soils formed in a thin mantle of loess and in the underlying glacial drift; on uplands

This map unit is on upland drift plains that are characterized by rolling topography. Areas are large and are throughout the county. Slopes range from 0 to 45 percent.

This map unit makes up about 28 percent of the survey area. It is about 24 percent Cincinnati soils, 18 percent Rossmoyne soils, 14 percent Hickory soils, and 44 percent soils of minor extent (fig. 3).

The gently sloping and moderately sloping, well drained Cincinnati soils are on summits, shoulder slopes, and back slopes. They have a slowly permeable fragipan in the subsoil. Typically, they have a dark brown silt loam

surface layer about 6 inches thick. The subsoil is yellowish brown, friable silt loam and silty clay loam and yellowish brown, mottled, firm clay loam in the upper part; a yellowish brown, mottled, very firm and brittle clay loam fragipan in the next part; and strong brown, mottled, firm silty clay loam in the lower part.

The nearly level and gently sloping, moderately well drained Rossmoyne soils are on summits, shoulder slopes, and the upper back slopes. They have a slowly permeable fragipan in the subsoil. Typically, they have a dark brown silt loam surface layer about 8 inches thick. The subsoil is yellowish brown, friable silt loam and yellowish brown, mottled, friable silt loam in the upper part; a yellowish brown, mottled, very firm and brittle silt loam fragipan in the next part; and yellowish brown, firm silt loam in the lower part.

The moderately sloping to very steep, well drained Hickory soils are on summits, shoulder slopes, and back slopes. Typically, they have a dark grayish brown, friable silt loam surface layer about 2 inches thick and a yellowish brown, friable silt loam subsurface layer about 2 inches thick. The subsoil is yellowish brown, friable silt loam and clay loam in the upper part and strong brown and dark yellowish brown, firm clay loam in the lower part. The substratum is dark yellowish brown loam.

The minor soils in the map unit are the somewhat poorly drained Avonburg soils on tabular divides and the upper back slopes; the somewhat poorly drained Holton soils on bottom land; the moderately deep, well drained Trappist soils on summits, shoulder slopes, and back slopes; and the well drained Wirt soils on narrow flood plains.

This map unit is used mainly for cultivated crops, hay, and pasture, but some areas remain in woodland. The major crops are corn, soybeans, small grain, and tobacco. Erosion is the main hazard in areas where cultivated crops are grown.

This map unit is suited to cultivated crops in the more nearly level areas and to pasture and hay in the steeper areas. Erosion is such a severe hazard on the steeper slopes that growing cultivated crops is impractical. The suitability for urban uses is good in the more nearly level areas and in areas where public sewer systems can be installed. Suitability is only fair for the more intensive types of recreational development because of slow permeability or the slope.

5. Eden-Carmel

Moderately deep and deep, moderately sloping to very steep, well drained soils formed in a thin mantle of loess and in material weathered from interbedded limestone and shale; on uplands

This map unit is on highly dissected uplands in nonglaciated areas. Areas are large and are mostly in the eastern part of the county. Slopes range from 6 to 50 percent.

This map unit makes up about 25 percent of the survey area. It is about 63 percent Eden soils, 13 percent Carmel soils, and 24 percent soils of minor extent (fig. 4).

The strongly sloping to very steep, moderately deep Eden soils are on shoulder slopes and back slopes. Typically, they have a dark brown flaggy silty clay loam surface layer about 6 inches thick. The subsoil is dark yellowish brown, firm silty clay loam in the upper part; light olive brown, very firm silty clay in the next part; and light olive brown, very firm flaggy silty clay in the lower part. It is underlain by slightly weathered, calcareous shale interbedded with strata of fractured limestone.

The moderately sloping, deep Carmel soils are on summits, shoulder slopes, and back slopes. Typically, they have a dark yellowish brown silt loam surface layer about 6 inches thick. The subsoil is strong brown, friable and firm silty clay loam in the upper part; strong brown, mottled, firm and very firm silty clay and clay in the next part; and yellowish brown, mottled, very firm clay in the lower part. The substratum is yellowish brown, mottled flaggy clay. It is underlain by interbedded calcareous clay shale and limestone.

The minor soils in the map unit are Dearborn, Beasley, Caneyville, Switzerland, and Bonnell soils. The deep Dearborn soils formed in local alluvium derived from limestone and shale. The deep Beasley soils formed in material weathered from soft limestone and calcareous shale and siltstone. The moderately deep Caneyville soils formed in limestone bedrock residuum. The deep Switzerland soils are moderately permeable in the upper part and very slowly permeable in the lower part. The deep Bonnell soils formed in a thin layer of loess and in the underlying glacial drift.

This map unit is used mainly for pasture or woodland, but some areas are used for hay or cultivated crops. Tobacco is the main cultivated crop. The slope is the major limitation, and erosion is the major hazard.

This map unit is suited to improved pasture. Erosion is such a severe hazard on the steeper slopes that growing cultivated crops is impractical. The unit is suited to woodland. The steeper slopes, however, restrict the use of logging equipment, and erosion is a hazard along logging roads and skid trails. The slope is such a severe limitation that the unit generally is unsuited to urban uses. Overcoming this limitation is difficult. Suitability for the more intensive types of recreational development is poor because of the slope.

6. Ryker-Grayford

Deep, nearly level to strongly sloping, well drained soils formed in a thin mantle of loess and in the underlying glacial drift and limestone residuum; on uplands

This map unit is on uplands that are on or near the edge of drift plains. Areas are narrow and elongated and

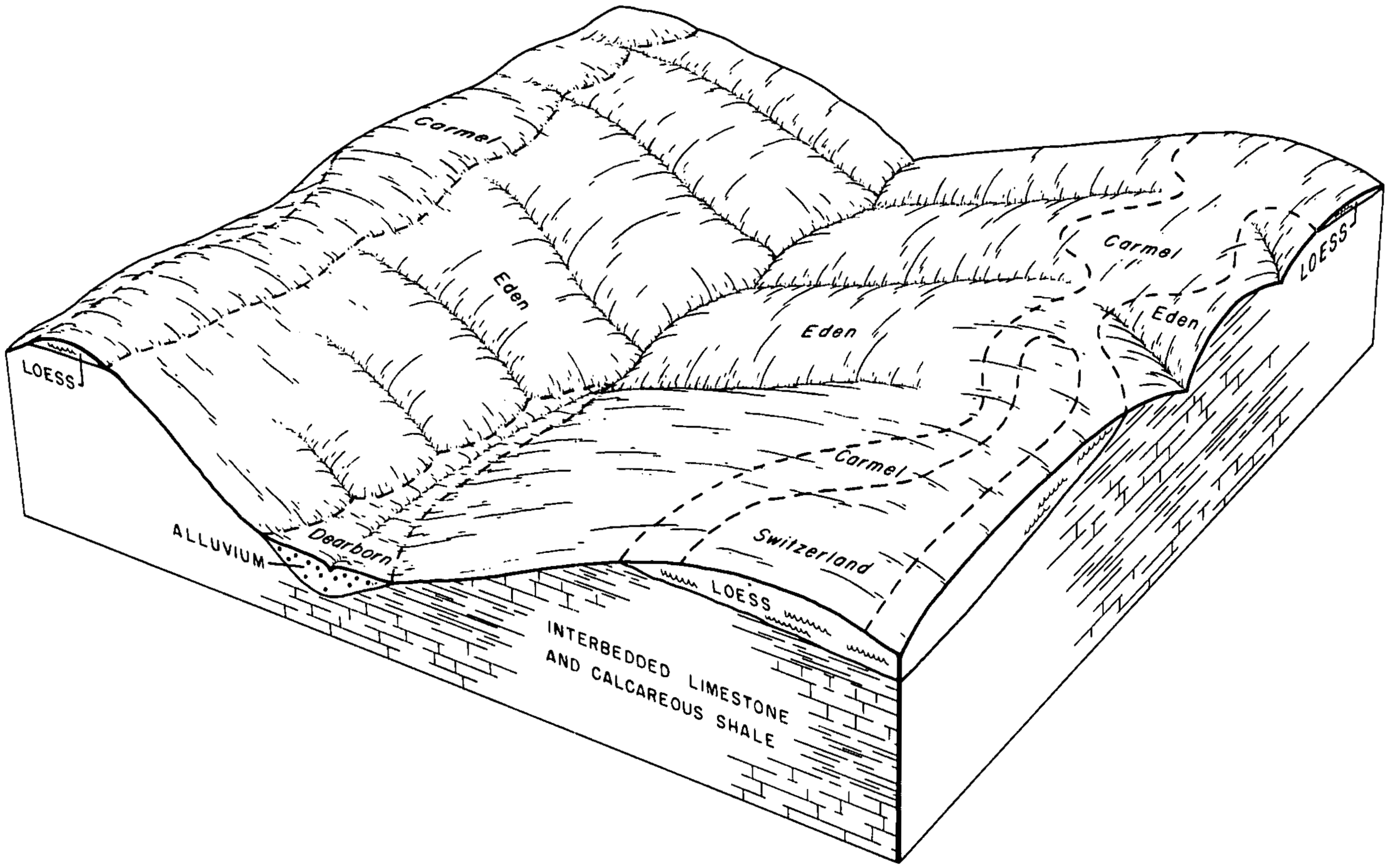


Figure 4.—Pattern of soils and parent material in the Eden-Carmel map unit.

follow a general north and south direction. Slopes range from 0 to 18 percent.

This map unit makes up about 9 percent of the survey area. It is about 57 percent Ryker soils, 14 percent Grayford soils, and 29 percent soils of minor extent (fig. 5).

The nearly level to moderately sloping Ryker soils are on summits, shoulder slopes, and back slopes. Typically, they have a dark brown silt loam surface layer about 6 inches thick and a yellowish brown silt loam subsurface layer about 6 inches thick. The subsoil is yellowish brown, friable silty clay loam and silt loam in the upper part and yellowish red, firm silty clay loam in the lower part.

The moderately sloping and strongly sloping Grayford soils are on summits, shoulder slopes, and back slopes. Typically, they have a dark brown silt loam surface layer about 6 inches thick. The subsoil is strong brown, friable silt loam in the upper part; yellowish red, firm loam and clay loam in the next part; and reddish brown, very firm clay in the lower part. It is underlain by limestone bedrock.

The minor soils in the map unit are Rossmoyne, Nicholson, Cincinnati, Carmel, and Switzerland soils. The moderately well drained Rossmoyne, moderately well drained and well drained Nicholson, and well drained Cincinnati soils have a fragipan in the subsoil. Carmel and Switzerland soils formed in a thin layer of loess and in the underlying material weathered from interbedded limestone and shale. All of the minor soils are on summits, shoulder slopes, and back slopes.

This map unit is used mainly for cultivated crops, but some areas are used for hay and pasture. The main crops are corn, soybeans, small grain, and tobacco. Erosion is the major hazard in some cultivated areas.

This map unit is suited to cultivated crops, to most specialty crops, and to hay and pasture. In many areas no hazards or limitations affect these uses, but erosion is a hazard in the more sloping areas. The suitability for urban uses is good in areas where restricted permeability

is not a serious limitation or where public sewer systems can be installed. Suitability is good for the more intensive types of recreational development.

Broad Land Use Considerations

Deciding which land should be used for urban development is an important issue in the county. Each year a considerable amount of land is developed for urban uses along the Ohio River and in scattered small areas throughout the county. An estimated 9,000 acres, or nearly 4 percent of the county, is urban or built-up land. The general soil map is helpful in planning the general outline of urban areas, but it cannot be used for the selection of sites for specific urban structures. The data about specific soils in the county can be helpful in planning future land use patterns.

Areas where the soils are so unfavorable that urban development is not desirable or is nearly prohibited are extensive in the county. Flooding is a severe hazard, for example, on the soils in the Wirt-Haymond map unit and on the Huntington and Dearborn soils in the Huntington-Dearborn-Elkinsville map unit. These soils are on flood plains. The slope is a severe limitation if the steeper soils in the Eden-Carmel map unit are used for urban development. Also, an extensive drainage system is needed on the wet soils in the Cobbsfork-Avonburg map unit.

Many areas of the Elkinsville soils in the Huntington-Dearborn-Elkinsville map unit and of the Ryker soils in the Ryker-Grayford map unit can be developed for urban uses at a comparatively low cost. These soils are well suited to urban development. Also, they are excellent farmland. Many areas of the Cincinnati and Rossmoyne soils in the Cincinnati-Rossmoyne-Hickory map unit and of the Carmel soils in the Eden-Carmel map unit can be developed for urban uses.

The Cincinnati-Rossmoyne-Hickory and Ryker-Grayford map units have good potential for most of the cultivated crops grown in the county. The Cobbsfork-Avonburg map unit has good potential for farming because many farmers have installed drainage systems that have sufficiently reduced the wetness of the major

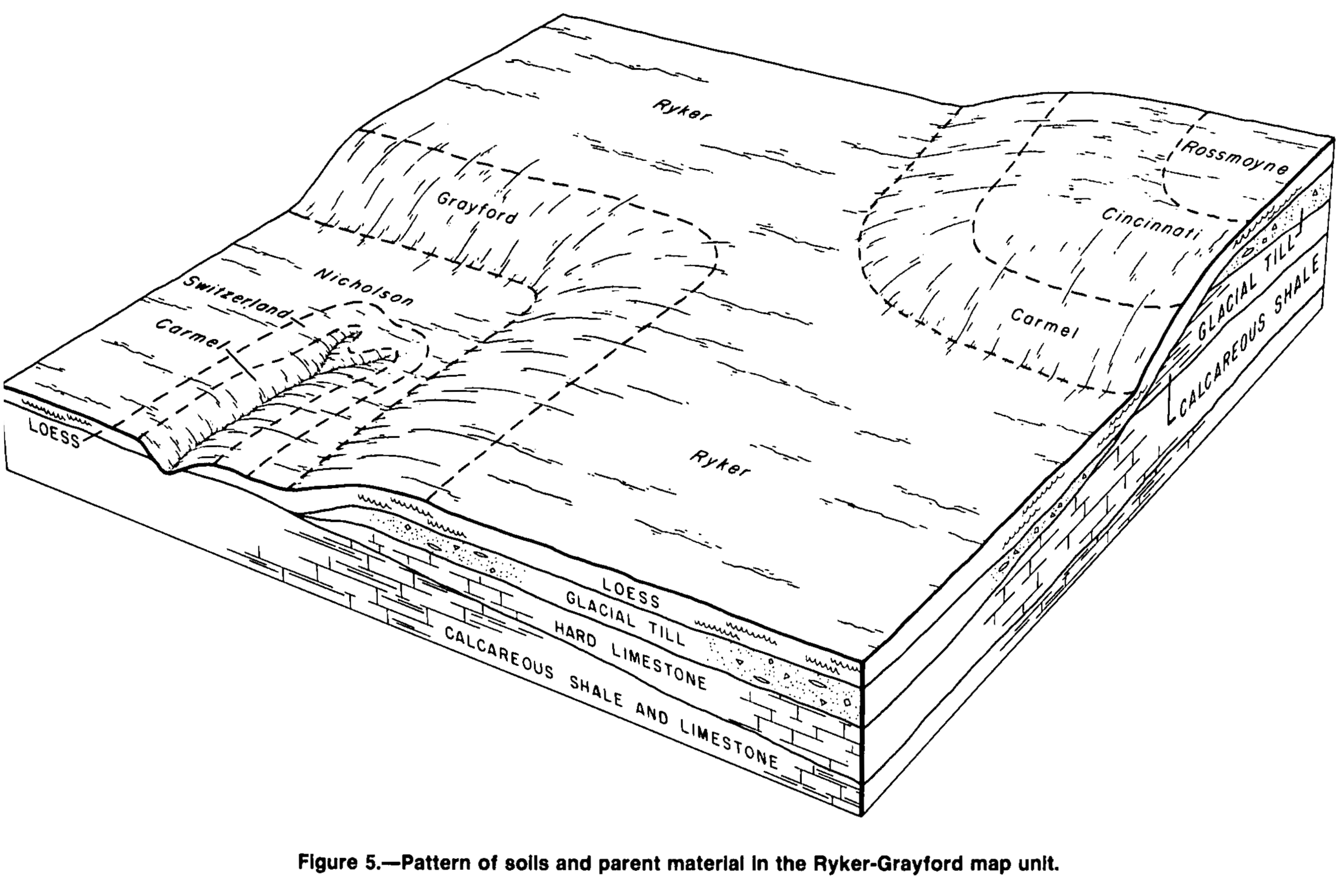


Figure 5.—Pattern of soils and parent material in the Ryker-Grayford map unit.

soils. The Wirt-Haymond and Huntington-Dearborn-Elkinsville map units also have good potential for farming, but flooding is a hazard. The steeper soils in the Eden-Carmel map unit have good potential for pasture if erosion is controlled.

The major soils in the Huntington-Dearborn-Elkinsville map unit and the Ryker soils in the Ryker-Grayford map unit are suited to vegetables and other specialty crops. Timely seeding and planting are needed on the Huntington soils to prevent crop damage caused by floodwater. All of these soils are well drained and warm up earlier in spring than the wetter soils. They are well suited to nursery crops in all areas, except for those where flooding is a hazard.

Most of the soils in the county have good or fair potential for woodland. Commercially valuable trees are less common on the wetter soils in the Cobbsfork-Avonburg map unit than on the soils in the other map units and generally do not grow so rapidly.

The Cincinnati-Rossmoyne-Hickory map unit has good potential for parks and extensive recreation areas. Hardwood forests enhance the beauty of some areas in this unit. The major soils in the Wirt-Haymond map unit and the Dearborn and Huntington soils in the Huntington-Dearborn-Elkinsville map unit are severely limited as sites for intensive recreation uses because of flooding. These soils have good potential for the recreation uses that can be restricted to the periods of the year when flooding is unlikely.

Most areas of the Eden-Carmel map unit are severely limited as sites for intensive recreation uses because of the slope. Many small areas in this map unit, however, have good potential for certain types of recreational development. Numerous small ravines, for example, have potential for small lakes and ponds. Wooded areas are abundant throughout most of this map unit.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Cincinnati silt loam, 6 to 12 percent slopes, eroded, is one of several phases in the Cincinnati series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Switzerland-Carmel silt loams, 2 to 12 percent slopes, eroded, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, quarries, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

The names, descriptions, and delineations of the soils identified on the detailed soil maps of this county do not always agree or join fully with those of the soils identified on the maps of adjoining counties published at an earlier date. For example, the Cobbsfork soils in this survey were correlated as Clermont soils in earlier surveys. Some differences are the result of changes in concepts of soil series. Other differences result from variations in the extent of the soils. Others are the result of variations in the slope range allowed in the map units.

Table 5 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

AvA—Avonburg silt loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is on smooth upland divides. Areas are broad and irregular in shape and are 20 to 200 acres in size. The dominant size is about 60 acres.

In a typical profile, the surface layer is about 10 inches of dark grayish brown silt loam. The subsoil to a depth of 80 inches is, in sequence downward, yellowish brown, mottled, friable silt loam; light brownish gray, mottled, friable silty clay loam; a light brownish gray, mottled, very firm silt loam fragipan; and light brownish gray, mottled, friable silt loam. Some small areas are gently sloping.

Included with this soil in mapping are small areas of the gently sloping, moderately well drained Rossmoyne soils. Also included, near the center of the divides, are a few small areas of the nearly level, poorly drained Cobbsfork soils. Included soils make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Avonburg soil. Permeability is very slow in and below the fragipan. Surface runoff is slow in cultivated areas. A perched

seasonal high water table is at a depth of 1 to 3 feet during a significant part of the year. Organic matter content is low in the surface layer. The fragipan restricts root penetration. The surface layer is dominantly strongly acid unless limed. It is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops. Some are used for hay or pasture. A few are used as woodland.

This soil is well suited to corn, soybeans, and small grain if a suitable drainage system is established and maintained. The wetness and the very slowly permeable fragipan are the major limitations. Excess water can be removed by shallow surface drains, tile drains, or a combination of these. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and organic matter content.

This soil is well suited to grasses for hay and pasture. It is poorly suited to deep-rooted legumes, such as alfalfa, however, because the very slowly permeable fragipan restricts root penetration and the downward movement of water. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedling mortality and the windthrow hazard are the main management concerns. Selecting special planting stock and overstocking help to overcome seedling mortality. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to overcome the windthrow hazard. When the soil is wet, logging roads tend to be slippery and ruts form quickly. The use of planting and logging equipment is limited during wet periods. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by cutting, spraying, or girdling.

Because of the wetness, this soil is severely limited as a site for dwellings. Subsurface drains help to lower the water table. The soil is severely limited as a site for local roads and streets because of low strength and frost action. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by frost action.

This soil generally is unsuitable as a septic tank absorption field because the wetness and the very slow permeability are severe limitations. Alternative sites should be selected, unless a sanitary sewer system is available.

The land capability classification is IIw. The woodland ordination symbol is 3d.

AvB2—Avonburg silt loam, 2 to 4 percent slopes, eroded. This gently sloping, deep, somewhat poorly drained soil is on divides and the upper back slopes near the head of drainageways in the uplands. Areas are narrow and irregularly shaped and are 5 to 30 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is about 7 inches of yellowish brown silt loam mixed with a small amount of light yellowish brown silt loam. The subsoil is 60 inches thick. It is mottled. The upper part is light yellowish brown, friable silt loam; the next part is a light brownish gray, firm silty clay loam fragipan; and the lower part is yellowish brown and strong brown, firm clay loam. The substratum to a depth of 80 inches is light brownish gray, mottled clay loam. Some small areas are nearly level.

Included with this soil in mapping are a few small areas of the moderately well drained Rossmoyne soils on summits and shoulder slopes. These soils make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Avonburg soil. Permeability is very slow in and below the fragipan. Surface runoff is medium. A perched seasonal high water table is at a depth of 1 to 3 feet during a significant part of the year. Organic matter content is low in the surface layer. The fragipan restricts root penetration. The surface layer is dominantly strongly acid unless limed. It is friable and can be easily worked.

Most areas are used for cultivated crops. Some are used for hay and pasture. A few are used as woodland.

This soil is well suited to corn, soybeans, small grain, and tobacco. Erosion is the major hazard, and the very slowly permeable fragipan and the wetness are the major limitations. Measures that control surface runoff and thus help to prevent excessive soil loss are needed in cultivated areas. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways (fig. 6), and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content. Subsurface tile is needed in seepy areas in some of the drainageways.

This soil is well suited to grasses and legumes for hay and pasture, but the growth of deep-rooted legumes, such as alfalfa, is restricted by the very slowly permeable fragipan, which restricts root penetration. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excess surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet

Figure 6.—A grassed waterway in an area of soybeans growing on Avonburg silt loam, 2 to 4 percent slopes, eroded.

periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedling mortality and the windthrow hazard are the main management concerns. Selecting special planting stock and overstocking help to overcome seedling mortality. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to overcome the windthrow hazard. When the soil is wet, logging roads tend to be slippery and ruts form quickly. The use of planting and logging equipment is limited during wet periods. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by cutting, spraying, or girdling.

Because of the wetness, this soil is severely limited as a site for dwellings. Subsurface drains help to lower the water table. The soil is severely limited as a site for local roads and streets because of low strength and frost action. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by frost action.

This soil generally is unsuitable as a septic tank absorption field because the wetness and the very slow permeability are severe limitations. Alternative sites should be selected, unless a sanitary sewer system is available.

The land capability classification is IIe. The woodland ordination symbol is 3d.

BeD3—Beasley-Rock outcrop complex, 12 to 25 percent slopes, severely eroded. This strongly sloping and moderately steep map unit occurs as areas of a deep, well drained Beasley soil closely intermingled with areas of Rock outcrop. The Beasley soil is on back slopes and shoulder slopes in the uplands, and the Rock outcrop occurs as narrow ledges following the contour along hillsides. Areas are elongated and irregularly shaped and are 10 to 100 acres in size, dominantly about 40 acres. They are about 65 percent Beasley soil and 20 percent Rock outcrop.

In a typical profile of the Beasley soil, the surface layer is dark brown silt loam about 3 inches thick. The subsoil is about 19 inches of yellowish brown and light olive brown, very firm silty clay and clay. The substratum is yellow, mottled silt loam about 22 inches thick. Light greenish gray siltstone and shale are at a depth of about 44 inches. In places the soil is underlain by interbedded limestone and calcareous shale.

Included with this unit in mapping, close to the Rock outcrop, are soils that are less than 20 inches deep over bedrock. Also included, on the upper part of the back slopes, are small areas of Grayford and Switzerland soils, the upper part of which formed in loess. Included soils make up about 15 percent of the map unit.

Available water capacity is moderate in the Beasley soil, and permeability is moderately slow. Surface runoff is very rapid. Organic matter content is moderate in the surface layer. This layer is dominantly neutral. The content of calcium, magnesium, phosphorus, and potassium is relatively high.

Most areas are used for permanent pasture or are idle. A few are used as woodland. This unit generally is unsuited to cultivated crops because of the strongly sloping and moderately steep slopes, a severe hazard of erosion, and a severe equipment limitation, which is the result of the Rock outcrop.

This unit is suited to grasses and legumes for permanent pasture. It is poorly suited to hay, however, because of the Rock outcrop. The slope and the hazard of erosion are the main management concerns. Establishing a permanent cover of grasses and legumes, tilling on the contour and minimizing tillage during seedbed preparation, and adding crop residue help to control surface runoff and erosion. Overgrazing or trampling by livestock when the soil is wet damages the sod, reduces plant density, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This unit is suited to trees. The main management concern is the equipment limitation. Operating ordinary crawler tractors and rubber-tired skidders can be hazardous because of the slope. The use of harvesting and planting machinery is restricted by the slope and the Rock outcrop. Disturbing the ground cover as little as possible when the trees are harvested helps to prevent excessive soil loss. Selecting special planting stock and overstocking help to overcome seedling mortality. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because the slope is a severe limitation, the Beasley soil generally is unsuitable as a site for dwellings. It is severely limited as a site for local roads and streets because of the slope and low strength. Cutting and filling and, if possible, building the roads on the contour help to overcome the slope. The base material can be strengthened or replaced with better suited material that can support vehicular traffic.

The Beasley soil generally is unsuitable as a septic tank absorption field because the slope and the moderately slow permeability are severe limitations. Alternative sites should be selected, unless a sanitary sewer system is available.

The land capability classification is VIe. The Beasley soil is assigned to woodland ordination symbol 4r; the Rock outcrop is not assigned to a woodland ordination symbol.

BnC2—Bonnell silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, well drained soil is on narrow summits and shoulder slopes in the uplands. Areas are narrow and elongated and are 5 to 30 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is about 7 inches of yellowish brown silt loam mixed with a small amount of subsoil material. The subsoil is about 45 inches thick. It is yellowish brown. The upper part is friable silt loam, and the lower part is very firm clay loam and clay. The substratum to a depth of about 60 inches is yellowish brown clay loam. In some areas the content of clay throughout the subsoil is less than 35 percent. In other areas, the soil formed in loess and residuum and is less than 60 inches deep over bedrock.

Included with this soil in mapping are the gently sloping and moderately sloping Cincinnati soils on some of the broader summits. These soils are less clayey than the Bonnell soil and have a fragipan. Also included are small areas of Crider Variant soils on the lower parts of the landscape. These soils are underlain by hard limestone bedrock. Included soils make up 10 to 12 percent of the map unit.

Available water capacity is high in the Bonnell soil, and permeability is slow. Surface runoff is rapid. Organic matter content is moderate in the surface layer. This layer is strongly acid unless limed. It is friable and can be easily worked.

Most areas are used for hay and pasture. Some are used for cultivated crops, are idle, or are used as woodland.

This soil is suited to corn, soybeans, small grain, and tobacco. Erosion is the major hazard. Measures that control surface runoff and thus help to prevent excessive soil loss are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. The equipment limitation and plant competition are the main

management concerns. When the soil is wet, logging roads tend to be slippery and ruts form quickly. The use of planting or logging equipment is limited during wet periods. Because of the erosion hazard, the grade of logging roads, skid trails, and landings should be gentle and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. Some replanting of seedlings may be needed. The seedlings usually grow well, however, if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential, this soil is severely limited as a site for dwellings. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The soil is severely limited as a site for local roads and streets because of low strength and the shrink-swell potential. The base material can be strengthened or replaced with better suited material that can support vehicular traffic.

This soil is severely limited as a septic tank absorption field because of the slow permeability. Installing the absorption field in suitable fill material helps to overcome this limitation.

The land capability classification is IIIe. The woodland ordination symbol is 2c.

BnC3—Bonnell silt loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, deep, well drained soil is on narrow summits and shoulder slopes in the uplands. Areas are narrow and elongated and range from 5 to 25 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is about 6 inches of yellowish brown silt loam mixed with strong brown subsoil material. It is dominantly subsoil material. The subsoil is about 64 inches thick. It is strong brown. The upper part is firm silty clay loam, and the lower part is very firm clay loam. The substratum to a depth of 80 inches is strong brown clay loam. In some areas the content of clay throughout the subsoil is less than 35 percent. In other areas the soil is formed in loess and residuum and is less than 60 inches deep over bedrock.

Included with this soil in mapping are small areas of the gently sloping Cincinnati soils on the higher lying shoulder slopes. These soils are less clayey than the Bonnell soil and have a fragipan. They make up 8 to 10 percent of the map unit.

Available water capacity is high in the Bonnell soil, and permeability is slow. Surface runoff is rapid. Because of the severe erosion, organic matter content is low in the surface layer and natural fertility is reduced. Also, tilth is poor because of the increased content of clay in the surface layer. This layer is dominantly strongly acid unless limed.

Most areas are used for hay and pasture. Some are used for cultivated crops, are idle, or are used as woodland.

This soil is poorly suited to corn, soybeans, small grain, and tobacco. Erosion is the major hazard. Measures that control surface runoff and thus help to prevent excessive soil loss are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay and is well suited to pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees. The equipment limitation, seedling mortality, and plant competition are the main management concerns. When the soil is wet, logging roads tend to be slippery and ruts form quickly. The use of planting or logging equipment is limited during wet periods. Because of the erosion hazard, the grade of logging roads, skid trails, and landings should be gentle. Selecting proper planting stock and limited overstocking help to overcome seedling mortality. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential, this soil is severely limited as a site for dwellings. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The soil is severely limited as a site for local roads and streets because of low strength and the shrink-swell potential. The base material can be strengthened or replaced with better suited material that can support vehicular traffic.

This soil is severely limited as a septic tank absorption field because of the slow permeability. Installing the absorption field in suitable fill material helps to overcome this limitation.

The land capability classification is IVe. The woodland ordination symbol is 3c.

BnD2—Bonnell silt loam, 12 to 18 percent slopes, eroded. This strongly sloping, deep, well drained soil is on narrow shoulder slopes and back slopes in the uplands. Areas are narrow and irregularly shaped and are 5 to 80 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is about 7 inches of yellowish brown silt loam mixed with a small amount of strong brown clay loam. The subsoil is very firm clay loam about 48 inches thick. The upper part is strong brown, and the lower part is yellowish brown. The substratum to a depth of 60 inches is yellowish brown loam. In some areas the content of clay throughout the subsoil is less than 35 percent. In other areas the soil is formed in loess and residuum and is less than 60 inches deep over bedrock.

Included with this soil in mapping are a few small areas of the moderately sloping Cincinnati soils on the upper part of the shoulder slopes. These soils are less clayey than the Bonnell soil and have a fragipan. They make up 5 to 10 percent of the map unit.

Available water capacity is high in the Bonnell soil, and permeability is slow. Surface runoff is very rapid. Organic matter content is moderate in the surface layer. This layer is dominantly strongly acid unless limed. It is friable and can be easily worked.

Most areas are used as woodland. Some are used for hay and pasture. A few small areas are cultivated.

This soil is poorly suited to corn, soybeans, and small grain. Erosion is the major hazard. Measures that control surface runoff and thus help to prevent excessive soil loss are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay and is well suited to pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to growing trees. The equipment limitation is the main management concern. When the soil is wet, logging roads tend to be slippery and ruts form quickly. The use of planting and logging equipment is limited during wet periods. Because of the erosion hazard, the grade of logging roads, skid trails, and landings should be gentle and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. Seedlings survive and grow well if competing vegetation is controlled and livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential and the slope, this soil is severely limited as a site for dwellings. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The dwellings should be designed so that they conform to the natural slope of the land. The soil is severely limited as a site for local roads and streets because of the shrink-swell potential, low strength, and the slope. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Cutting and filling and, if possible, building the roads on the contour help to overcome the slope.

This soil is severely limited as a septic tank absorption field because of the slope and the slow permeability. Land shaping and installation of the distribution lines across the slope generally are needed before the absorption field can function properly. Installing the absorption field in suitable fill material helps to overcome the slow permeability.

The land capability classification is IVe. The woodland ordination symbol is 2r.

BnD3—Bonnell silt loam, 12 to 18 percent slopes, severely eroded. This strongly sloping, deep, well drained soil is on narrow shoulder slopes and back slopes in the uplands. Areas are narrow and irregularly shaped and are 5 to 60 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is about 3 inches of brown silt loam mixed with yellowish brown silty clay loam subsoil material. It is dominantly subsoil material. The subsoil is about 62 inches thick. It is strong brown. The upper part is firm silty clay loam, and the lower part is very firm clay loam. The substratum to a depth of 80 inches is strong brown, firm clay loam. In some areas the content of clay throughout the subsoil is less than 35 percent. In other areas the soil is formed in loess and residuum and is less than 60 inches deep over bedrock.

Included with this soil in mapping are a few small areas of the moderately sloping Cincinnati soils on the upper part of the shoulder slopes. These soils are less clayey than the Bonnell soil and have a fragipan. They make up 8 to 10 percent of the map unit.

Available water capacity is high in the Bonnell soil, and permeability is slow. Surface runoff is very rapid. Because of the severe erosion, organic matter content is low in the surface layer and natural fertility is reduced. The surface layer is dominantly strongly acid unless limed.

Most areas are used for hay and pasture or for woodland. Some are idle. A few small areas are cultivated.

This soil generally is unsuited to row crops because of the slope and a severe hazard of erosion. Small grain is occasionally grown so that stands of grasses and legumes can be reestablished.

This soil is suited to grasses and legumes for pasture, but it is poorly suited to hay because of the slope and the severe hazard of erosion. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees. The equipment limitation is the main management concern. When the soil is wet, logging roads tend to be slippery and ruts form quickly. The use of planting or logging equipment is limited during wet periods. Because of the erosion hazard, the grade of logging roads, skid trails, and landings should be gentle and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. Selecting proper planting stock and limited overstocking help to overcome seedling mortality. Seedlings survive and grow well if competing vegetation is controlled and livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the slope and the shrink-swell potential, this soil is severely limited as a site for dwellings. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The dwellings should be designed so that they conform to the natural slope of the land. The soil is severely limited as a site for local roads and streets because of low strength, the shrink-swell potential, and the slope. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Cutting and filling and, if possible, building the roads on the contour help to overcome the slope.

This soil is severely limited as a septic tank absorption field because of the slope and the slow permeability. Land shaping and installation of the distribution lines across the slope generally are needed before the absorption field can function properly. Installing the absorption field in suitable fill material helps to overcome the slow permeability.

The land capability classification is VIe. The woodland ordination symbol is 3r.

BnE—Bonnell silt loam, 18 to 45 percent slopes. This moderately steep to very steep, deep, well drained soil is on back slopes in the uplands. Areas are narrow and irregularly shaped and are 10 to 60 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is brown silt loam about 4 inches thick. The subsurface layer is yellowish brown silt loam about 4 inches thick. The subsoil is about 57 inches thick. The upper part is yellowish brown, friable silt loam, and the lower part is yellowish brown and strong brown, firm and very firm clay loam. The substratum to a depth of 80 inches is strong brown, very firm clay loam. In some areas the content of clay throughout the subsoil is less than 35 percent. In other areas the soil is formed in loess and residuum and is less than 60 inches deep over bedrock.

Included with this soil in mapping are a few small areas of Cincinnati soils on back slopes and shoulder slopes. These soils are less clayey than the Bonnell soil and have a fragipan. They make up 8 to 10 percent of the map unit.

Available water capacity is high in the Bonnell soil, and permeability is slow. Surface runoff is very rapid. Organic matter content is moderate in the surface layer. This layer is dominantly medium acid.

Most areas are used as woodland. Some are used for hay and pasture, and a few are idle. This soil generally is unsuited to cultivated crops because of the slope and a severe hazard of erosion.

This soil is suited to grasses and legumes for pasture, but it is poorly suited to hay because of the slope. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. The equipment limitation is the main management concern. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on these slopes. Because of the erosion hazard, the grade of logging roads, skid trails, and landings should be gentle and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. Seedlings survive and grow well if competing vegetation is controlled and livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because the slope and the shrink-swell potential are severe limitations, this soil generally is unsuitable as a site for dwellings. It is severely limited as a site for local roads because of the shrink-swell potential, low strength, and the slope. The base material can be strengthened or replaced with better suited material that can support

vehicular traffic. Cutting and filling and, if possible, building the roads on the contour help to overcome the slope.

This soil generally is unsuitable as a septic tank absorption field because the slope and the slow permeability are severe limitations. Alternative sites should be selected, unless a sanitary sewer system is available.

The land capability classification is VIe. The woodland ordination symbol is 2r.

CaF—Caneyville-Rock outcrop complex, 25 to 60 percent slopes. This steep and very steep map unit is on back slopes in the uplands. It occurs as areas of a moderately deep, well drained Caneyville soil closely intermingled with areas of Rock outcrop. Areas are elongated and irregularly shaped. They are 15 to more than 100 acres in size, dominantly about 40 acres. They are 60 to 80 percent Caneyville soil and 10 to 25 percent Rock outcrop.

In a typical profile of the Caneyville soil, the surface layer is about 5 inches of dark brown silt loam. The subsoil is about 24 inches thick. It is reddish brown and very firm. The upper part is silty clay, and the lower part is clay. Hard limestone bedrock is at a depth of about 29 inches. In some areas the surface layer is stony silt loam or stony silty clay loam. In other areas the bedrock is interbedded limestone and shale.

Included with this unit in mapping, on the upper back slopes, summits, and shoulder slopes, are small areas of the deep Grayford and Ryker soils, the upper part of which formed in loess. These soils make up 8 to 10 percent of the map unit. Also included, in areas near the Rock outcrop, are soils that are less than 20 inches deep over bedrock and have a dark surface layer that is more than 6 inches thick and, on the upper back slopes near ridgetops, small areas of the deep Bonnell and Grayford soils and small severely eroded spots where chert is exposed. These included areas make up 10 to 15 percent of the map unit.

Available water capacity is low in the Caneyville soil, and permeability is moderately slow. Surface runoff is very rapid. Organic matter content is moderate in the surface layer. This layer is dominantly slightly acid. Natural fertility is moderate, and the content of calcium and magnesium is relatively high.

Most areas are used as woodland. A few are used for grasses and legumes for pasture. A few are idle. This unit generally is unsuited to cultivated crops because of the steep and very steep slope and a severe hazard of erosion.

Because of the slope and the Rock outcrop, this unit is poorly suited to grasses and legumes for permanent pasture and is not suited to hay. The slope and the hazard of erosion are the main management concerns. Machinery that can be operated on steep and very steep slopes should be used during seedbed preparation. Permanent stands of grasses and legumes help to control surface runoff and erosion. Overgrazing or trampling by livestock when the soil is wet damages the sod, reduces plant density and forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The Caneyville soil is suited to trees. The erosion hazard and the equipment limitation are the main management concerns. Because of the erosion hazard, the grade of logging roads, skid trails, and landings should be gentle and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on these slopes. Seedlings can survive and grow well if competing vegetation is controlled and livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because the slope and the depth to bedrock are severe limitations, the Caneyville soil generally is unsuitable as a site for dwellings. It is severely limited as a site for local roads and streets because of the slope and low strength. Cutting and filling and, if possible, building the roads and streets on the contour help to overcome the slope. The base material can be strengthened or replaced with better suited material that can support vehicular traffic.

The Caneyville soil generally is unsuitable as a septic tank absorption field because the slope, the depth to bedrock, and the moderately slow permeability are severe limitations.

The land capability classification is VIIe. The Caneyville soil is assigned to woodland ordination symbol 2c; the Rock outcrop is not assigned to a woodland ordination symbol.

CcC2—Carmel silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, well drained soil is on summits and shoulder slopes in the uplands. Areas are narrow and elongated and are 5 to 35 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is about 6 inches of dark yellowish brown silt loam mixed with a small amount of strong brown silty clay loam. The subsoil is about 37 inches thick. The upper part is strong brown, friable and firm silty clay loam, and the lower part is strong brown, mottled, firm and very firm clay and silty clay. The substratum is about 7 inches of yellowish brown, mottled clay and flaggy clay. Interbedded shale and limestone are at a depth of about 50 inches. In some areas the soil is underlain by siltstone. In other areas it is 20 to 40 inches deep over bedrock.

Included with this soil in mapping are the gently sloping and moderately sloping Switzerland soils on

some of the broader summits. These soils formed in 20 to 36 inches of loess and in the underlying residuum. They make up 8 to 10 percent of the map unit.

Available water capacity is moderate in the Carmel soils, and permeability is very slow. Surface runoff is rapid. Organic matter content is moderate in the surface layer. This layer is dominantly strongly acid unless limed. It is friable and can be easily worked.

Most areas are used for hay and pasture. Some are used for cultivated crops, are idle, or are used as woodland.

This soil is suited to corn, soybeans, small grain, and tobacco. Erosion is the major hazard. Measures that control surface runoff and thus help to prevent excessive soil loss are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. A cover of grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedling mortality and the windthrow hazard are the main management concerns. Some replanting of seedlings may be needed. The seedlings usually grow well, however, if competing vegetation is controlled and livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow.

Because of the shrink-swell potential, this soil is severely limited as a site for dwellings. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The soil is severely limited as a site for local roads and streets because of low strength and the shrink-swell potential. The base material can be strengthened or replaced with better suited material that can support vehicular traffic.

This soil is severely limited as a septic tank absorption field because of the very slow permeability. Installing the absorption field in suitable fill material helps to overcome this limitation.

The land capability classification is IIIe. The woodland ordination symbol is 1c.

CdC3—Carmel silty clay loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, deep, well drained soil is on summits and shoulder slopes in the uplands. Areas are narrow and elongated and are from 5 to 25 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is about 6 inches of yellowish brown silty clay loam mixed with a small amount of dark yellowish brown silt loam. The subsoil is yellowish brown, very firm silty clay about 35 inches thick. It is mottled in the lower part. Calcareous clay shale interbedded with thin layers of limestone is at a depth of about 41 inches. In some areas the soil is underlain by limestone, calcareous shale, and siltstone. In other areas it is 20 to 40 inches deep over bedrock.

Included with this soil in mapping are the gently sloping and moderately sloping Switzerland soils on the higher summits. These soils formed in 20 to 36 inches of loess and in the underlying residuum. They make up 8 to 10 percent of the map unit.

Available water capacity is low in the Carmel soil, and permeability is very slow. Surface runoff is rapid. Because of the severe erosion, organic matter content is low in the surface layer and natural fertility is reduced. Also, tilth is poor because of the increased content of clay in the surface layer. This layer is dominantly strongly acid unless limed. It is firm, and if tilled when wet, it becomes cloddy and cannot be easily worked.

Most areas are used for hay and pasture. Some are used for cultivated crops, are idle, or are used as woodland.

This soil is poorly suited to corn, soybeans, small grain, and tobacco. Erosion is the major hazard. Measures that control surface runoff and thus help to prevent excessive soil loss are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay and is well suited to pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedling mortality and the windthrow hazard are the main management concerns. Selecting proper planting stock and limited overstocking help to overcome seedling mortality. Harvest methods that do not isolate the remaining trees

or leave them widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling. When the soil is wet, logging roads tend to be slippery and ruts form quickly. The use of planting or logging equipment is limited during wet periods.

Because of the shrink-swell potential, this soil is severely limited as a site for dwellings. Strengthening foundations, footings, and basement walls and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling. The soil is severely limited as a site for local roads and streets because of low strength and the shrink-swell potential. The base material can be strengthened or replaced with better suited material that can support vehicular traffic.

This soil is severely limited as a septic tank absorption field because of the very slow permeability. Installing the absorption field in suitable fill material helps to overcome this limitation.

The land capability classification is IVe. The woodland ordination symbol is 2c.

CnB2—Cincinnati silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on narrow summits and shoulder slopes in the uplands. Areas are narrow and irregularly shaped and are 5 to 30 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is about 6 inches of dark brown silt loam mixed with a small amount of yellowish brown silt loam. The subsoil extends to a depth of 80 inches. The upper part is yellowish brown, mottled, firm clay loam; the next part is a yellowish brown, mottled, very firm clay loam fragipan; and the lower part is strong brown, mottled, firm silty clay loam. In some small areas the soil is moderately well drained. In places it is underlain by limestone or shale.

Included with this soil in mapping are a few small areas of the moderately sloping Bonnell, Hickory, and Ryker soils on back slopes. These soils do not have a fragipan. Also included, along drainageways, are small areas of the somewhat poorly drained Holton soils, which formed in alluvium. Included soils make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Cincinnati soil. Permeability is slow in and below the fragipan. Surface runoff is medium in cultivated areas. The soil has a perched seasonal high water table. Organic matter content is moderate in the surface layer. The fragipan restricts root penetration. The surface layer is dominantly strongly acid unless limed. It is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for hay and pasture. Some are used for cultivated crops. A few small areas are used as woodland.

This soil is well suited to corn, soybeans, small grain, and tobacco. Measures that control surface runoff and thus help to prevent excessive soil loss are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

This soil is suitable as a site for dwellings without basements but is moderately limited as a site for dwellings with basements because of the wetness. Subsurface drains can help to lower the water table. The soil is severely limited as a site for local roads and streets because of low strength and frost action. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Frost action can be controlled by replacing or covering the upper soil layers with suitable base material.

Because of the slow permeability in the fragipan, this soil is severely limited as a septic tank absorption field. Installing the absorption field in more rapidly permeable fill material can help the soil to absorb liquid waste more readily.

The land capability classification is IIe. The woodland ordination symbol is 2a.

CnC2—Cincinnati silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, well drained soil is on summits, shoulder slopes, and back slopes in the uplands. Areas are narrow and elongated and are 20 to 80 acres in size. The dominant size is about 40 acres.

In a typical profile, the surface layer is about 6 inches of dark brown silt loam mixed with a small amount of yellowish brown silty clay loam. The subsoil extends to a depth of about 80 inches. It is yellowish brown. The upper part is mottled, firm silty clay loam; the next part is a mottled, very firm silty clay loam and clay loam

fragipan; and the lower part is yellowish brown, firm clay loam. In some small areas the soil is moderately well drained and is underlain by interbedded limestone, calcareous shale, or black shale bedrock.

Included with this soil in mapping are small areas of the strongly sloping Bonnell and Hickory soils on back slopes. These soils do not have a fragipan. Also included are small areas of the somewhat poorly drained Holton soils, which formed in alluvium along drainageways. Included soils make up 8 to 10 percent of the map unit.

Available water capacity is moderate in the Cincinnati soil. Permeability is slow in and below the fragipan. Surface runoff is medium in cultivated areas. The soil has a perched seasonal high water table. Organic matter content is moderate in the surface layer. The fragipan restricts root penetration. The surface layer is dominantly strongly acid unless limed. It is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for hay and pasture. Some are used for cultivated crops. A few small areas are used as woodland.

This soil is suited to corn, soybeans, and small grain. The hazard of erosion is severe. One or more measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, excessive surface runoff, and poor tilth. Proper stocking rates, pasture rotation, additions of lime and fertilizer, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the slope, this soil is moderately limited as a site for dwellings without basements. Because of the slope and the wetness, it is moderately limited as a site for dwellings with basements. The buildings should be designed so that they conform to the natural slope of the land. Subsurface drains can help to lower the water table. The soil is severely limited as a site for local roads and streets because of low strength and frost action. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Frost action can be controlled by replacing or covering the upper soil layers with suitable base material.

This soil is severely limited as a septic tank absorption field because of the slow permeability. Installing the absorption field in more rapidly permeable fill material helps to overcome this limitation.

The land capability classification is IIIe. The woodland ordination symbol is 2a.

CnC3—Cincinnati silt loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, deep, well drained soil is on summits, shoulder slopes, and back slopes in the uplands. Areas are narrow and elongated and are from 15 to 40 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is about 6 inches of yellowish brown silt loam mixed with a small amount of dark yellowish brown silt loam. The subsoil is about 71 inches thick. It is yellowish brown and mottled. The upper part is firm silty clay loam, the next part is a very firm clay loam fragipan, and the lower part is firm clay loam. The substratum to a depth of more than 80 inches is yellowish brown, mottled clay loam. In some areas the soil is moderately well drained and is underlain by interbedded limestone, calcareous shale, or black shale bedrock.

Included with this soil in mapping are small areas of the strongly sloping Bonnell and Hickory soils on back slopes. These soils do not have a fragipan. Also included are small areas of the somewhat poorly drained Holton soils, which formed in alluvium along drainageways. Included soils make up 8 to 10 percent of the map unit.

Available water capacity is moderate in the Cincinnati soil. Permeability is slow in and below the fragipan. Surface runoff is medium in cultivated areas. The soil has a perched seasonal high water table. Organic matter content is low in the surface layer. The fragipan restricts root penetration. The surface layer is dominantly strongly acid unless limed. It is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for hay and pasture. Some are used for cultivated crops.

This soil is poorly suited to corn, soybeans, and small grain. The hazard of erosion is severe. One or more measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay and is well suited to pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction, excessive surface runoff, and poor tilth. Proper stocking rates, pasture rotation, additions of lime and fertilizer, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the slope, this soil is moderately limited as a site for dwellings without basements. Because of the slope and the wetness, it is moderately limited as a site for dwellings with basements. The buildings should be designed so that they conform to the natural slope of the land. Subsurface drains can help to lower the water table. The soil is severely limited as a site for local roads and streets because of low strength and frost action. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Frost action can be controlled by replacing or covering the upper soil layers with suitable base material.

This soil is severely limited as a septic tank absorption field because of the slow permeability. Installing the absorption field in more rapidly permeable fill material helps to overcome this limitation.

The land capability classification is IVe. The woodland ordination symbol is 2a.

Co—Cobbsfork silt loam. This nearly level, deep, poorly drained soil is on tabular divides in the uplands. It is subject to ponding. Areas are broad and irregularly shaped and are 40 to 2,000 acres in size. The dominant size is about 200 acres.

In a typical profile, the surface layer is about 6 inches of grayish brown silt loam. The subsurface layer also is about 6 inches of grayish brown silt loam. The subsoil extends to a depth of about 80 inches. The upper part is light gray and light brownish gray, mottled silt loam; the next part is light brownish gray and yellowish brown, mottled, firm and brittle silt loam; and the lower part is strong brown, firm clay loam. In some areas the firm and brittle layers make up more than 60 percent of the soil volume.

Included with this soil in mapping are the somewhat poorly drained Avonburg soils near the edges of the

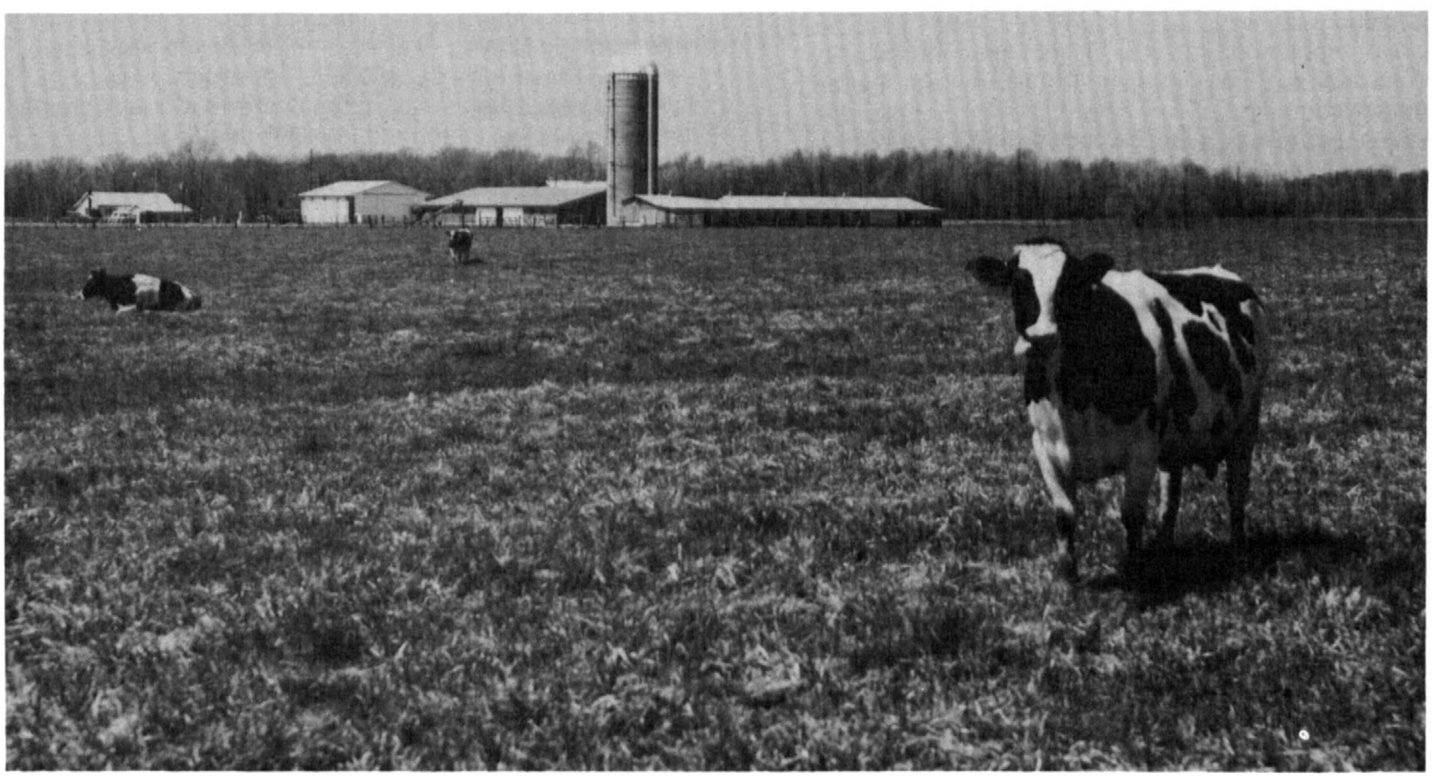


Figure 7.—Dairy cows in a pastured area of Cobbsfork silt loam.

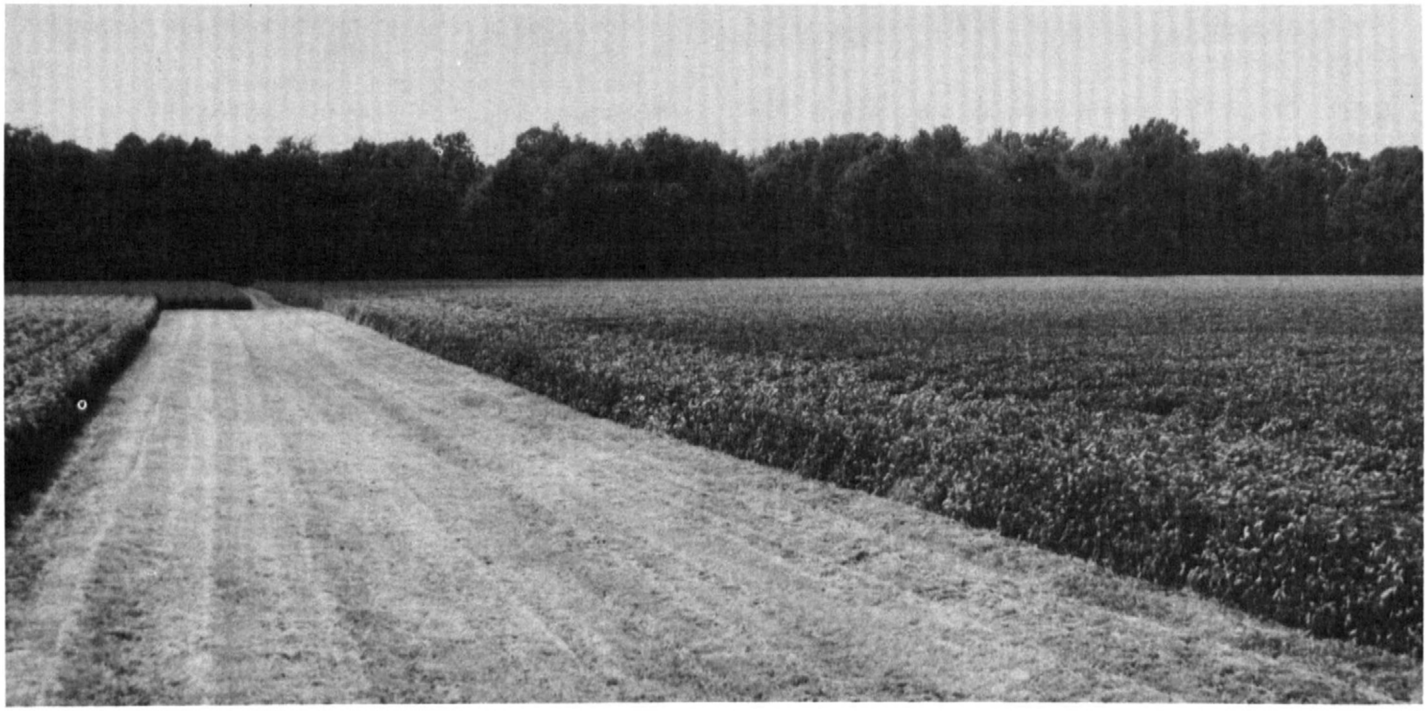


Figure 8.—Drainage ditch in an area of Cobbsfork silt loam used for soybeans.

divides. These soils make up 8 to 10 percent of the map unit.

Available water capacity is very high in the Cobbsfork soil, and permeability is very slow. Surface runoff is very slow in cultivated areas. A perched seasonal high water table is near or above the surface during a significant part of the year. Organic matter content is low in the surface layer. This layer is dominantly strongly acid unless limed. It is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops. Some are used for hay, pasture (fig. 7), or woodland.

This soil is suited to corn, soybeans, and small grain if a suitable drainage system is established and maintained (fig. 8). The wetness is the major limitation. The excess water can be removed by shallow surface drains, tile drains, or a combination of these. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface improve or maintain tilth and organic matter content.

This soil is well suited to grasses for hay and pasture, but it is poorly suited to deep-rooted legumes, such as alfalfa, because of the prolonged, excessive wetness. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, additions of lime and fertilizer, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The prolonged seasonal wetness hinders harvesting and logging and the planting of seedlings. Equipment should be used only during periods when the soil is relatively dry or frozen. Special site preparation, such as bedding, helps to control seedling mortality. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Special harvest methods and adequate site preparation may be needed to control plant competition. Excluding livestock from the wooded areas helps seedlings to survive and grow well.

Because of the ponding, this soil is severely limited as a site for dwellings. It is severely limited as a site for local roads and streets because of the ponding and frost action. Subsurface drains can help to lower the water table. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by frost action.

This soil generally is unsuitable as a septic tank absorption field because the ponding and the very slow permeability are severe limitations. Alternative sites should be selected, unless a sanitary sewer system is available.

The land capability classification is IIIw. The woodland ordination symbol is 1w.

CrB2—Crider Variant silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on summits and shoulder slopes in the uplands. Areas are narrow and irregularly shaped and are 5 to 60 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is about 7 inches of dark yellowish brown silt loam mixed with a small amount of yellowish brown silt loam. The subsoil is about 51 inches thick. The upper part is yellowish brown, friable silt loam and silty clay loam, and the lower part is yellowish red, very firm clay. Hard limestone bedrock is at a depth of about 58 inches. In places the depth to bedrock is more than 60 inches.

Included with this soil in mapping are Bonnell, Deputy, and Jennings soils. Bonnell soils formed in a thin layer of loess and in the underlying drift. They are on back slopes. Deputy soils formed in loess and in the underlying shale residuum. They are on summits and shoulder slopes. Jennings soils are on back slopes. They have a fragipan. Included soils make up 10 to 12 percent of the map unit.

Available water capacity is high in the Crider Variant soil, and pemeability is moderate. Surface runoff is medium. Organic matter content is moderate in the surface layer. This layer is dominantly medium acid unless limed. It is friable and can be easily worked.

Most areas are used for cultivated crops. Some are used for hay and pasture or for small grain.

This soil is well suited to corn, soybeans, small grain, and tobacco. Erosion is the major hazard. One or more measures that help to control surface runoff and thus prevent excessive soil loss are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, additions of lime and fertilizer, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the depth to bedrock, this soil is moderately limited as a site for dwellings with basements. Applying measures that overcome this limitation generally is expensive. The soil is better suited to dwellings without basements. It is severely limited as a site for local roads and streets because of low strength and frost action. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Frost action can be controlled by replacing or covering the upper soil layers with suitable base material.

This soil is moderately limited as a septic tank absorption field because of the moderate permeability and the depth to bedrock. Installing the absorption field in suitable fill material helps to overcome these limitations.

The land capability classification is IIe. The woodland ordination symbol is 1a.

Da—Dearborn silt loam, frequently flooded. This nearly level, deep, well drained soil is on toe slopes and bottom land. It is frequently flooded for very brief periods of highly intensive rainfall. It is adjacent to rapidly flowing streams that drain steep upland soils underlain by calcareous shale and limestone bedrock. Areas are narrow and elongated and are 5 to 80 acres in size. The dominant size is about 40 acres.

In a typical profile, the surface layer is about 6 inches of dark brown silt loam. The subsoil is brown, friable silt loam about 7 inches thick. The substratum to a depth of 60 inches is brown stratified channery loam and channery silt loam. In some areas the surface layer is loam or silty clay loam. In other areas the surface layer and subsoil are thicker and contain more silt and less sand.

Included with this soil in mapping, on back slopes at the higher elevations, are Eden and Pate soils, which formed in material weathered from limestone and shale. Eden soils are moderately deep. Also included, at the slightly higher elevations, are soils that formed in colluvium on foot slopes and small areas of Wirt soils on bottom land. Wirt soils formed in alluvium having a lower content of clay and coarse fragments than the alluvium in which the Dearborn soil formed. Included soils make up 10 to 12 percent of the map unit.

Available water capacity is moderate in the Dearborn soil. Permeability is moderate in the subsoil. Surface runoff is slow in cultivated areas. Organic matter content is moderate in the surface layer. This layer is moderately alkaline. It is friable and can be easily worked. The content of calcium, magnesium, phosphorus, and potassium is relatively high.

Most areas are used for hay and pasture, but many are used for cultivated crops. Some are idle, and a few are used for woodland.

This soil is suited to corn and tobacco. The main hazard is the frequent flooding. The main limitation is the droughtiness that occurs in summer because of the moderate available water capacity.

This soil is well suited to grasses and legumes for hay or pasture. The main limitation is the droughtiness that occurs in summer because of the moderate available water capacity. Overgrazing or trampling by livestock when the soil is wet damages the sod, reduces plant density and forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. The equipment limitation and plant competition are the main management concerns. The use of planting or logging equipment is limited during wet periods. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because the frequent flooding is a severe hazard, this soil generally is unsuitable as a site for dwellings and sanitary facilities and is severely limited as a site for local roads and streets. Areas used for local roads and streets should be protected from flooding, or alternative sites should be selected.

The land capability classification is IIIs. The woodland ordination symbol is 2f.

Db—Dearborn channery silt loam, frequently flooded. This nearly level, deep, well drained soil is on toe slopes and bottom land. It is frequently flooded for very brief periods after highly intensive rainfall. It is adjacent to rapidly flowing streams that drain steep and very steep upland soils underlain by calcareous shale and limestone bedrock. Scattered fragments of limestone are on the surface. Areas are narrow and elongated and are 5 to 80 acres in size. The dominant size is about 40 acres.

In a typical profile, the surface layer is about 11 inches of dark brown channery silt loam. The subsoil is about 17 inches of dark brown, loose and friable extremely channery coarse loamy sand and channery loam. The upper part of the substratum is yellowish brown extremely channery coarse sandy loam. The lower part to a depth of 60 inches is yellowish brown, loose extremely flaggy loamy sand. In some areas the surface layer is loam, silty clay loam, channery loam, or flaggy loam. In other areas the surface layer and subsoil are thicker and contain more silt and less sand.

Included with this soil in mapping, on back slopes at the higher elevations, are Eden and Pate soils, which formed in material weathered from limestone and shale. These soils are more clayey than the Dearborn soil. Eden soils are moderately deep. Also included, at the slightly higher elevations, are soils that formed in colluvium on foot slopes and small areas of Wirt soils on bottom land. Wirt soils formed in alluvium having a lower content of clay and coarse fragments than the alluvium in which the Dearborn soil formed. Included soils make up 10 to 12 percent of the map unit.

Available water capacity is moderate in the Dearborn soil. Permeability is moderate in the subsoil. Surface runoff is slow. Organic matter content is moderate in the surface layer. This layer is moderately alkaline. It is friable but cannot be easily worked because it is channery. The content of calcium, magnesium, phosphorus, and potassium is relatively high.

Most areas are used for hay and pasture (fig. 9), but many are idle. A few are used as woodland.

This soil is suited to cultivated crops. The main hazard is the frequent flooding. Also, the soil is droughty in summer because of the moderate available water capacity and has a channery surface layer, which cannot be easily worked.

This soil is well suited to grasses and legumes for hay and pasture. The main limitations are the summer droughtiness and the channery surface layer. Overgrazing or trampling by livestock when the soil is wet damages the sod, reduces plant density and forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. The equipment limitation and plant competition are the main management concerns. The use of planting and logging equipment is limited during wet periods. The growth of black walnut and other species that require a soil free of coarse fragments is somewhat restricted because of a limited rooting depth. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because the frequent flooding is a severe hazard, this soil generally is unsuitable as a site for dwellings and sanitary facilities and is severely limited as a site for local roads and streets. Areas used for local roads and streets should be protected from flooding, or alternative sites should be selected.

The land capability classification is IIIs. The woodland ordination symbol is 2f.

DeB2—Deputy silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, moderately well drained soil is on summits and shoulder slopes in the uplands. Areas are narrow and elongated and are 10 to 150 acres in size. The dominant size is about 20 acres.

Figure 9.—A pastured area of Dearborn channery silt loam, frequently flooded. Eden soils are on the steeper slopes in the background.

In a typical profile, the surface layer is about 8 inches of dark brown silt loam mixed with a small amount of yellowish brown silt loam. The subsoil is about 45 inches thick. The upper part is yellowish brown, friable silt loam and firm silty clay loam, and the lower part is yellowish brown and light gray, mottled, very firm silty clay. Silty clay shale bedrock is at a depth of about 53 inches. In a few small areas glacial drift is in the surface layer and subsoil. In some small areas the soil is 30 to 40 inches deep over bedrock.

Included with this soil in mapping, at the lower elevations on shoulder slopes and back slopes, are the well drained Crider Variant soils, which formed in a thin layer of loess and in the underlying limestone residuum. Also included, on back slopes at the higher elevations, are the well drained Jennings soils, which have a fragipan. Included soils make up about 8 to 10 percent of the map unit.

Available water capacity is high in the Deputy soil. Permeability is moderate in the upper part of the soil and moderately slow in the lower part. Surface runoff is medium. A perched seasonal high water table is at a depth of 1.5 to 3.0 feet in winter and spring. Organic matter content is moderate in the surface layer. This layer is dominantly strongly acid unless limed. It is friable and can be easily worked.

Most areas are used for hay and pasture. Some are used for cultivated crops, are idle, or are used for woodland.

This soil is well suited to corn, soybeans, small grain, and tobacco. Erosion is the major hazard. One or more measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming,

grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the wetness, this soil is limited as a site for dwellings. Subsurface drains can help to lower the water table. The soil is limited as a site for local roads and streets because of low strength and frost action. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by frost action.

This soil is severely limited as a septic tank absorption field because of the moderately slow permeability and the wetness. Installing the absorption field in more rapidly permeable fill material can help the soil to absorb liquid waste more readily. Providing suitable fill material also helps to overcome the wetness.

The land capability classification is IIe. The woodland ordination symbol is 2a.

DeC2—Deputy silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, moderately well drained soil is on back slopes in the uplands. Areas are narrow and elongated and are 10 to 60 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is about 8 inches of dark yellowish brown silt loam mixed with a small amount of yellowish brown subsoil material. The subsoil is about 47 inches thick. The upper part is strong brown and yellowish brown, friable silt loam and firm silty clay loam; the next part is brown and reddish brown, firm and very firm silty clay loam; and the lower part is dark yellowish brown, firm silty clay. Shale bedrock is at a depth of about 55 inches. In some areas glacial drift is in the surface layer and subsoil. In some small areas the soil is 30 to 40 inches deep over bedrock.

Included with this soil in mapping, at the lower elevations on shoulder slopes and back slopes, are the well drained Crider Variant soils, which formed in a thin layer of loess and in the underlying limestone residuum. Also included, on back slopes at the higher elevations, are the well drained Jennings soils, which have a fragipan. Included soils make up 8 to 10 percent of the map unit.

Available water capacity is high in the Deputy soil. Permeability is moderate in the upper part of the soil and moderately slow in the lower part. Surface runoff is rapid. A perched seasonal high water table is at a depth of 1.5 to 3.0 feet in winter and spring. Organic matter content is moderate in the surface layer. This layer is dominantly strongly acid unless limed.

Most areas are used for hay and pasture. Some are used for cultivated crops, are idle, or are used as woodland.

This soil is suited to corn, soybeans, small grain, and tobacco. Erosion is the major hazard. One or more measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, additions of lime and fertilizer, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the wetness and the slope, this soil is limited as a site for dwellings. Subsurface drains can help to lower the water table. The dwellings should be designed so that they conform to the natural slope of the land. The soil is limited as a site for local roads and streets because of low strength and frost action. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by frost action.

This soil is severely limited as a septic tank absorption field because of the moderately slow permeability and the wetness. Installing the absorption field in more

rapidly permeable fill material helps to overcome the moderately slow permeability. Providing suitable fill material also helps to overcome the wetness.

The land capability classification is IIIe. The woodland ordination symbol is 2a.

DeC3—Deputy silt loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, deep, moderately well drained soil is on back slopes and hillsides in the uplands. Areas are narrow and elongated and are 10 to 60 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is about 7 inches of yellowish brown silt loam mixed with a large amount of strong brown silty clay loam subsoil material. The subsoil is silty clay loam about 43 inches thick. The upper part is strong brown and firm, the next part is strong brown, mottled, and very firm, and the lower part is reddish brown, mottled, and firm. Shale bedrock is at a depth of about 50 inches. In some areas glacial drift is in the surface layer and subsoil. In some small areas the soil is 30 to 40 inches deep over bedrock.

Included with this soil in mapping, at the lower elevations on shoulder slopes and back slopes, are the well drained Crider Variant soils, which formed in a thin layer of loess and in the underlying limestone residuum. Also included, on back slopes at the higher elevations, are the well drained Jennings soils, which have a fragipan. Included soils make up 8 to 10 percent of the map unit.

Available water capacity is high in the Deputy soil. Permeability is moderate in the upper part of the soil and moderately slow in the lower part. Surface runoff is rapid. A perched seasonal high water table is at a depth of 1.5 to 3.0 feet in winter and spring. Because of the severe erosion, organic matter content is low in the surface layer and natural fertility is reduced. The surface layer is dominantly very strongly acid unless limed.

Most areas are used for hay and pasture or are wooded. Some are used for cultivated crops.

This soil is poorly suited to corn, soybeans, and small grain. Erosion is the major hazard. Measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay and well suited to pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the wetness and the slope, this soil is limited as a site for dwellings. Subsurface drains can help to lower the water table. The dwellings should be designed so that they conform to the natural slope of the land. The soil is limited as a site for local roads and streets because of low strength and frost action. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by frost action.

This soil is severely limited as a septic tank absorption field because of the moderately slow permeability and the wetness. Installing the absorption field in more rapidly permeable fill material helps to overcome the moderately slow permeability. Providing suitable fill material also helps to overcome the wetness.

The land capability classification is IVe. The woodland ordination symbol is 2a.

Du—Dumps. This nearly level map unit is in areas of Elkinsville, Huntington, and Markland soils where basins have been constructed for the purpose of collecting sediment from the exhaust gasses in the Clifty Creek Power Plant. There are three of these sediment basins. They range from 20 to 168 acres in size.

The three basins contain liquid, 1 to 10 feet deep, and silt-size particles of ash that varies in chemical composition. The basins are exposed to sunlight, rainfall, and wind. Some areas within the basins are not covered with liquids. These areas are unstable. The ash is subject to soil blowing, particularly during periods of freezing, thawing, and drying.

Soil blowing can be controlled either by keeping the entire surface area of the basins continuously covered with liquids or by vegetating the areas exposed to the wind. The bare areas could be vegetated if the discharge liquid were pumped farther out into the basins. Pumping the liquid would protect the exposed areas near the plant from reflooding and make possible the establishment of a vegetative cover. Also, dikes or additional channels could be constructed to prevent flooding of the vegetated areas. Seeding or sodding in bands perpendicular to the direction of the prevailing wind would reduce the velocity of the wind at the surface and thus would reduce the susceptibility of the ash to soil blowing.

Plant research and test plots indicate that some plant species, such as fescue and adapted herbaceous and woody plants, survive reasonably well, especially in areas where a trace amount of soil is mixed with the ash. In vegetated areas fertilizer containing nitrogen, phosphorus, and potassium should be applied. Mulching these areas conserves moisture and helps to prevent soil blowing.

No land capability classification or woodland ordination symbol is assigned.

EeD2—Eden silty clay loam, 12 to 25 percent slopes, eroded. This moderately deep, strongly sloping and moderately steep, well drained soil is on long, narrow summits and the upper back slopes in the uplands. Areas are elongated and irregularly shaped and are 10 to several hundred acres in size.

In a typical profile, the surface layer is about 5 inches of dark brown silty clay loam mixed with a small amount of brown and yellowish brown silty clay loam. The subsoil is about 18 inches thick. The upper part is brown and yellowish brown, very firm silty clay, and the lower part is light yellowish brown, mottled, very firm flaggy clay. Soft, calcareous shale and limestone bedrock is at a depth of about 23 inches. In some small areas the depth to bedrock is more than 40 inches. In places the bedrock is hard limestone.

Included with this soil in mapping are small areas of the deep Dearborn soils, which formed in alluvium along drainageways. Also included are the deep Switzerland soils at the higher elevations on summits, shoulder slopes, and back slopes. Included soils make up 8 to 10 percent of the map unit.

Available water capacity is low in the Eden soil, and permeability is slow. Surface runoff is very rapid. Organic matter content is moderate in the surface layer. This layer is dominantly neutral.

Most areas are used for pasture. Some are used for hay or woodland. A few are idle.

This soil is poorly suited to corn, soybeans, small grain, and tobacco in areas where the slope is less than 18 percent. It is unsuited to cultivated crops in areas where the slope is 18 percent or more. Erosion is the major hazard. Measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay and well suited to pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees. The equipment limitation and the windthrow hazard are the main management concerns. When the soil is wet, logging roads tend to be slippery and ruts form quickly. The use of planting or logging equipment is limited during wet periods. Some replanting of seedlings may be needed. Seedlings generally survive and grow well, however, if competing vegetation is controlled and livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling. Disturbing the ground cover as little as possible helps to prevent excessive soil loss. Because of the erosion hazard, the grade of logging roads, skid trails, and landings should be gentle and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow.

Because of the slope, this soil is severely limited as a site for dwellings. The dwellings should be designed so that they conform to the natural slope of the land. The soil is severely limited as a site for local roads and streets because of the slope and low strength. Building local roads on the contour and land shaping help to overcome the slope. The base material can be strengthened or replaced with better suited material that can support vehicular traffic.

This soil is severely limited as a septic tank absorption field because of the slow permeability, the slope, and the depth to bedrock. Installing the absorption field in suitable fill material helps to overcome the slow permeability. Land shaping and installation of the distribution lines across the slope generally are needed before the absorption field can function properly. Filling or mounding the site with suitable filtering material helps to overcome the limited depth to bedrock.

The land capability classification is IVe. The woodland ordination symbol is 3c.

EfF—Eden flaggy silty clay loam, 25 to 50 percent slopes. This steep and very steep, moderately deep, well drained soil is on back slopes in the uplands. Areas are elongated and irregular in shape and are 50 to several thousand acres in size. The dominant size is about 500 acres.

In a typical profile, the surface layer is about 6 inches of dark brown flaggy silty clay loam. The subsoil is about 33 inches thick. The upper part is dark yellowish brown, firm silty clay loam; the next part is light olive brown, very firm silty clay; and the lower part is light olive brown, very firm flaggy silty clay. Calcareous shale interbedded with limestone is at a depth of about 39 inches. In some

Figure 10.—A pastured area of Eden flaggy silty clay loam, 25 to 50 percent slopes.

small areas the depth to bedrock is more than 40 inches. In places the bedrock is hard limestone.

Included with this soil in mapping are small areas of the deep Dearborn soils, which formed in alluvium along drainageways. Also included are the deep Switzerland soils at the higher elevations on summits, shoulder slopes, and back slopes. Included soils make up 8 to 10 percent of the map unit.

Available water capacity is moderate in the Eden soil, and permeability is slow. Surface runoff is very rapid. Organic matter content is moderate in the surface layer. This layer is dominantly neutral. The content of calcium, magnesium, phosphorus, and potassium is relatively high.

Most areas are used as woodland. Some are used for permanent pasture. A few are idle.

Because of the steep and very steep slope and a severe hazard of erosion, this soil generally is unsuited to cultivated crops and hay and is poorly suited to grasses and legumes for permanent pasture (fig. 10). Machinery that can be operated on these steep and very steep slopes should be used during seedbed preparation. Permanent stands of grasses and legumes help to control surface runoff and erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees. The erosion hazard, the equipment limitation, and the windthrow hazard are the

main management concerns. Because of the erosion hazard, the grade of roads, skid trails, and landings should be gentle and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. Also, the ground cover should be disturbed as little as possible. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on these slopes. Seedlings can survive and grow well if competing vegetation is controlled and livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow.

Because the steep or very steep slope is a severe limitation, this soil generally is unsuitable as a site for dwellings or septic tank absorption fields. It is severely limited as a site for local roads and streets because of the slope and low strength. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Cutting and filling and, if possible, building roads on the contour help to overcome the slope. Soil slippage generally is a problem if the surface is disturbed (fig. 11).

The land capability classification is VIIe. The woodland ordination symbol is 3r.

EgG—Eden-Caneyville complex, 25 to 60 percent slopes. These steep and very steep, moderately deep, well drained soils are on back slopes in the uplands. They are on long slopes that face the Ohio River and on back slopes adjacent to tributaries near the river. The Eden soil is on the lower part of the back slopes. The Caneyville soil occurs as narrow bands on the upper part of the back slopes. Areas are elongated and irregularly shaped and are dominantly several thousand acres in size. They are about 65 percent Eden soil and 20 percent Caneyville soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

In a typical profile of the Eden soil, the surface layer is about 4 inches of very dark grayish brown flaggy silt loam. The subsurface layer is about 4 inches of dark brown silty clay loam. The subsoil is about 26 inches thick. It is brown and dark yellowish brown, very firm silty clay and clay in the upper part and dark yellowish brown and yellowish brown, very firm channery clay and very flaggy clay in the lower part. Calcareous shale interbedded with limestone is at a depth of about 34 inches. In some areas the depth to bedrock is more than 40 inches.

In a typical profile of the Caneyville soil, the surface layer is about 5 inches of very dark grayish brown silt loam. The subsoil is about 29 inches thick. The upper part is brown, firm silty clay loam, and the lower part is yellowish red, very firm silty clay. Hard limestone bedrock is at a depth of about 34 inches. In some small areas the soil has a dark surface layer that is 7 to 10 inches thick.

Included with these soils in mapping are small areas of the deep Dearborn soils, which formed in alluvium along drainageways. Also included are small areas of the deep Grayford soils on the upper part of back slopes, on shoulder slopes, and on summits. Included soils make up 15 percent of the map unit.

Available water capacity is low in the Eden and Caneyville soils. Permeability is slow in the Eden soil and moderately slow in the Caneyville soil. Surface runoff is very rapid on both soils. Organic matter content is moderate in the surface layer. The surface layer of the Eden soil is dominantly mildly alkaline, and that of the Caneyville soil is dominantly neutral. The content of calcium, magnesium, phosphorus, and potassium is relatively high in the Eden soil. It is lower in the Caneyville soil.

Most areas are used as woodland. A few are used for permanent pasture. A few are idle.

Because of the steep and very steep slope and a severe hazard of erosion, these soils generally are unsuited to cultivated crops and hay and are poorly suited to grasses and legumes for permanent pasture. Machinery that can be operated on these steep and very steep slopes should be used during seedbed preparation. Permanent stands of grasses and legumes help to control surface runoff and erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

These soils are suited to trees. The erosion hazard, the equipment limitation, and the windthrow hazard are the main management concerns. Because of the erosion hazard, the grade of logging roads, skid trails, and landings should be gentle and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. Also, the ground cover should be disturbed as little as possible. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on these slopes. Seedlings can survive and grow well if competing vegetation is controlled and livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow.

Because of the slope and the depth to bedrock, these soils generally are unsuitable as sites for dwellings. They are severely limited as sites for local roads and streets because of the slope and low strength. Building roads on the contour and land shaping help to overcome the slope. The base material can be strengthened or replaced with better suited material that can support

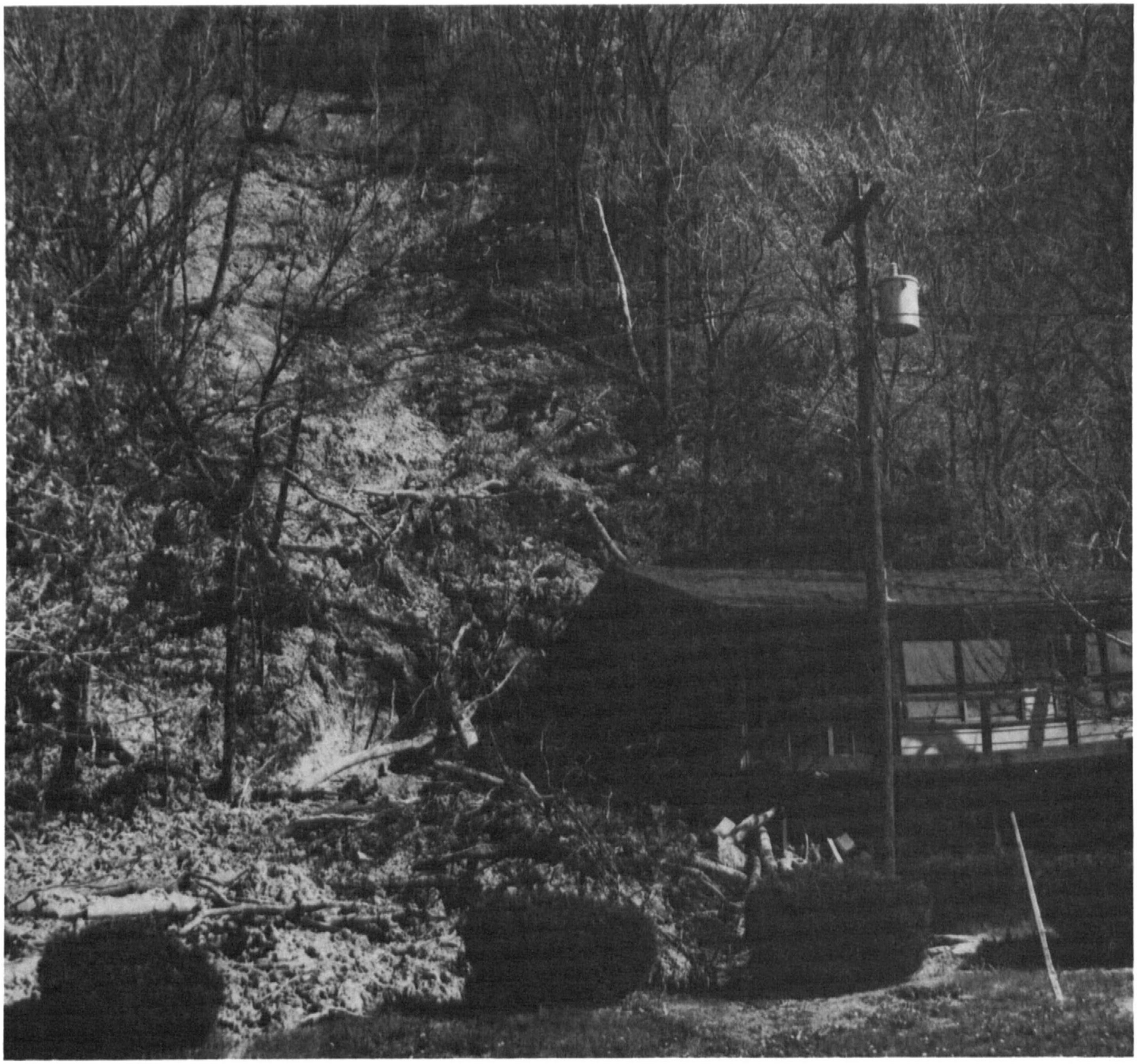


Figure 11.—An area of Eden flaggy silty clay loam, 25 to 50 percent slopes, where soil slippage has damaged a house.

vehicular traffic. The soils generally are unsuitable as septic tank absorption fields because the slope, the depth to bedrock, and the slow or moderately slow permeability are severe limitations.

The land capability classification is VIIe. The woodland ordination symbol is 3r.

EkA—Elkinsville silt loam, 0 to 2 percent slopes, rarely flooded. This nearly level, deep, well drained soil is on broad terraces along the Ohio River. It is between steep and very steep Eden soils on upland back slopes and lower lying soils on bottom land. It is subject to rare flooding. Areas are broad and irregular in shape and are

30 to 80 acres in size. The dominant size is about 50 acres.

In a typical profile, the surface layer is about 11 inches of dark brown silt loam. The subsoil is about 59 inches thick. The upper part is yellowish brown, friable silt loam, and the lower part is strong brown and yellowish brown, friable silt loam and loam. The substratum to a depth of 80 inches is dark yellowish brown, friable stratified loam and fine sandy loam. In some areas the surface layer is loam, fine sandy loam, or loamy fine sand. In other areas the subsoil is slightly acid.

Included with this soil in mapping are small areas of Huntington soils on bottom land along the Ohio River. These soils formed in neutral recent alluvium. They are less acid than the Elkinsville soil. Also included, near the center of the stream terraces, are small areas of the moderately well drained Pekin soils, which have a fragipan. Included soils make up 5 to 10 percent of the map unit.

Available water capacity is very high in the Elkinsville soil, and permeability is moderate. Surface runoff is medium. Organic matter content is moderate in the surface layer. This layer is dominantly strongly acid unless limed. It is friable and can be easily worked.

Most areas are used for cultivated crops. Some are used for pasture and hay or for urban development.

This soil is well suited to corn, soybeans, and small grain. No severe limitations or hazards affect the use of the soil for these crops. A conservation tillage system that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops improve or maintain tilth and organic matter content. A subsurface drainage system is needed in seepy areas in some of the drainageways and swales.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or trampling when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because the rare flooding is a severe hazard, this soil generally is unsuitable as a site for dwellings. A few of the higher lying areas, however, are not subject to flooding. The soil is severely limited as a site for local roads and streets because of low strength and frost action. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Frost action can be controlled by replacing or covering the upper soil layers with suitable base material.

This soil is moderately limited as a septic tank absorption field because of the rare flooding. The lower lying areas generally are unsuitable for this use because of the flooding. A few of the higher lying areas are better suited because they are not subject to flooding.

The land capability classification is I. The woodland ordination symbol is 1a.

EkB—Elkinsville silt loam, 2 to 8 percent slopes, rarely flooded. This gently sloping, deep, well drained soil is on old stream terraces. It is higher on the landscape than the adjoining alluvial soils. It is subject to rare flooding. Areas are irregularly shaped and are 5 to 100 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is about 8 inches of dark brown silt loam. The subsoil is about 38 inches thick. It is dark yellowish brown, friable silt loam in the upper part and yellowish brown, firm silty clay loam and friable silt loam and loam in the lower part. The substratum to a depth of about 60 inches is yellowish brown loam and sandy loam. In some areas the surface layer is loam. In some small areas the soil has more sand throughout the surface layer and subsoil and is underlain by gravel.

Included with this soil in mapping are small areas of Huntington soils on bottom land along the Ohio River. These soils formed in neutral recent alluvium. They are less acid than the Elkinsville soil. Also included, near the center of the stream terraces, are small areas of the moderately well drained Pekin soils, which have a fragipan. Included soils make up 5 to 10 percent of the map unit.

Available water capacity is high in the Elkinsville soil, and permeability is moderate. Surface runoff is medium in cultivated areas. Organic matter content is moderate in the surface layer. This layer is dominantly strongly acid unless limed. It is friable and can be easily worked.

Most areas are used for cultivated crops. Some are used for hay and pasture.

This soil is well suited to corn, soybeans, small grain, and tobacco. Erosion is the major hazard. Measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, diversions, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes

surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because the rare flooding is a severe hazard, this soil generally is unsuitable as a site for dwellings. A few of the higher lying areas, however, are not subject to flooding. The soil is severely limited as a site for local roads and streets because of low strength and frost action. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Frost action can be controlled by replacing or covering the upper soil layers with suitable base material.

This soil is moderately limited as a septic tank absorption field because of the rare flooding. The lower lying areas generally are unsuitable for this use because of the flooding. The higher lying areas are better suited because they are flooded less frequently.

The land capability classification is IIe. The woodland ordination symbol is 1a.

GrC2—Grayford silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, well drained soil is on summits, shoulder slopes, and the upper back slopes in the uplands. Areas are narrow and irregularly shaped and are 5 to 20 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is about 7 inches of dark yellowish brown silt loam mixed with a small amount of yellowish brown subsoil material. The subsoil is about 47 inches thick. The upper part is yellowish brown, friable silt loam; the next part is strong brown and yellowish red, firm clay loam; and the lower part is yellowish red, very firm clay. Hard limestone bedrock is at a depth of about 54 inches. In some areas the depth to limestone bedrock is more than 60 inches. In other areas the surface layer and subsoil have no glacial drift.

Included with this soil in mapping are small areas of Beasley and Caneyville soils on back slopes at the lower elevations. These soils are more clayey than the Grayford soil. Beasley soils formed in material weathered from soft limestone and calcareous shale and siltstone. The moderately deep Caneyville soils formed in limestone bedrock residuum. Also included are small areas of Wirt soils along drainageways. These soils formed in alluvium. They are more sandy than the Grayford soil. Included soils make up 5 to 10 percent of the map unit.

Available water capacity is high in the Grayford soil, and permeability is moderate. Surface runoff is rapid. Organic matter content is moderate in the surface layer. This layer is dominantly strongly acid or medium acid unless limed. It is friable and can be easily worked.

Most areas are used for hay and pasture. Some are used for cultivated crops. Others are used as woodland or are idle.

This soil is suited to corn, soybeans, small grain, and tobacco. Erosion is the major hazard. Measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the slope and the shrink-well potential, this soil is moderately limited as a site for dwellings. The depth to bedrock also is a moderate limitation on sites for dwellings with basements. Overcoming this limitation generally is expensive. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The dwellings should be designed so that they conform to the natural slope of the land. The soil is severely limited as a site for local roads and streets because of frost action. Replacing or covering the upper soil layers with suitable base material helps to prevent the road damage caused by frost action.

This soil is moderately limited as a septic tank absorption field because of the slope, the moderate permeability, and the depth to bedrock. Land shaping and installation of the distribution lines across the slope generally are needed before the absorption field can function properly. Providing suitable fill material helps to overcome the moderate permeability. Filling or mounding

the site with suitable filtering material helps to overcome the limited depth to bedrock.

The land capability classification is IIIe. The woodland ordination symbol is 1a.

GrC3—Grayford silt loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, deep, well drained soil is on summits, shoulder slopes, and the upper back slopes in the uplands. Areas are narrow and irregularly shaped and are 5 to 20 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is about 6 inches of brown and yellowish red silt loam. It is dominantly subsoil material. The subsoil is about 52 inches thick. The upper part is yellowish red, firm loam and clay loam, and the lower part is dark reddish brown, very firm clay. Hard limestone bedrock is at a depth of about 58 inches. In some areas the depth to limestone bedrock is more than 60 inches. In other areas the surface layer and subsoil have no glacial drift.

Included with this soil in mapping are small areas of Beasley and Caneyville soils on back slopes at the lower elevations. These soils are more clayey than the Grayford soil. Beasley soils formed in material weathered from soft limestone and calcareous shale and siltstone. The moderately deep Caneyville soils formed in limestone bedrock residuum. Also included are small areas of Wirt soils along drainageways. These soils formed in alluvium. They are more sandy than the Grayford soil. Included soils make up 8 to 10 percent of the map unit.

Available water capacity is high in the Grayford soil, and permeability is moderate. Surface runoff is rapid. Because of the severe erosion, organic matter content is low in the surface layer and natural fertility is reduced. The surface layer is dominantly strongly acid unless limed.

Most areas are used for hay and pasture. Some are used for cultivated crops, are idle, or are used as woodland.

This soil is poorly suited to corn, soybeans, small grain, and tobacco. Erosion is the major hazard. One or more measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay and is well suited to pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the area. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the slope and the shrink-well potential, this soil is moderately limited as a site for dwellings. The depth to bedrock also is a moderate limitation on sites for dwellings with basements. Overcoming this limitation generally is expensive. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The dwellings should be designed so that they conform to the natural slope of the land. The soil is severely limited as a site for local roads and streets because of frost action. Replacing or covering the upper soil layers with suitable base material helps to prevent the road damage caused by frost action.

This soil is moderately limited as a septic tank absorption field because of the slope, the moderate permeability, and the depth to bedrock. Land shaping and installation of the distribution lines across the slope generally are needed before the absorption field can function properly. Providing suitable fill material helps to overcome the moderate permeability. Filling or mounding the site with suitable filtering material helps to overcome the limited depth to bedrock.

The land capability classification is IVe. The woodland ordination symbol is 1a.

GrD2—Grayford silt loam, 12 to 18 percent slopes, eroded. This strongly sloping, deep, well drained soil is on shoulder slopes and back slopes in the uplands. Areas are narrow and irregularly shaped and are 5 to 80 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is about 6 inches of dark brown silt loam mixed with a small amount of strong brown silt loam. The subsoil is about 46 inches thick. The upper part is strong brown, friable silt loam; the next part is yellowish red, firm loam and clay loam; and the lower part is reddish brown, very firm clay. Hard limestone bedrock is at a depth of about 52 inches. In some areas the depth to limestone bedrock is more than 60 inches. In other areas the surface layer and subsoil have no glacial drift.

Included with this soil in mapping are small areas of Beasley and Caneyville soils on back slopes at the lower elevations. These soils are more clayey than the Grayford soil. Beasley soils formed in material weathered from soft limestone and calcareous shale and siltstone.

The moderately deep Caneyville soils formed in limestone bedrock residuum. Also included are small areas of Wirt soils along drainageways. These soils formed in alluvium. They are more sandy than the Grayford soil. Included soils make up 5 to 10 percent of the map unit.

Available water capacity and permeability are moderate in the Grayford soil. Surface runoff is very rapid. Organic matter content is moderate in the surface layer. This layer is dominantly strongly acid or medium acid unless limed. It is friable and can be easily worked.

Most areas are used as woodland. Some are used for hay and pasture. A few small areas are used for cultivated crops.

This soil is poorly suited to corn, soybeans, and small grain. Erosion is the major hazard. One or more measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay and is well suited to pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the slope and the shrink-swell potential, this soil is limited as a site for dwellings. The depth to bedrock also is a limitation on sites for dwellings with basements. Overcoming this limitation generally is expensive. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The dwellings should be designed so that they conform to the natural slope of the land. This soil is severely limited as a site for local roads and streets because of the slope and frost action. Replacing or covering the upper soil layers with suitable base material helps to prevent the road damage caused by frost action. Building roads on the contour and land shaping help to overcome the slope.

This soil is limited as a septic tank absorption field because of the slope, the moderate permeability, and the depth to bedrock. Land shaping and installation of the distribution lines across the slope generally are needed before the absorption field can function properly. Providing suitable fill material helps to overcome the moderate permeability. Filling or mounding the site with suitable filtering material helps to overcome the limited depth to bedrock.

The land capability classification is IVe. The woodland ordination symbol is 1a.

GrD3—Grayford silt loam, 12 to 18 percent slopes, severely eroded. This strongly sloping, deep, well drained soil is on shoulder slopes and back slopes in the uplands. Areas are narrow and irregularly shaped and are 5 to 60 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is about 8 inches of strong brown silt loam mixed with a small amount of dark brown silt loam. It is dominantly subsoil material. The subsoil is about 41 inches thick. The upper part is yellowish red and strong brown, firm and very firm silty clay loam and clay loam, and the lower part is dark red, very firm clay. Hard limestone bedrock is at a depth of about 49 inches. In some areas the depth to limestone bedrock is more than 60 inches. In other areas the surface layer and subsoil have no glacial drift.

Included with this soil in mapping are small areas of Beasley and Caneyville soils on back slopes at the lower elevations. These soils are more clayey than the Grayford soil. Beasley soils formed in material weathered from soft limestone and calcareous shale and siltstone. The moderately deep Caneyville soils formed in limestone bedrock residuum. Also included are small areas of Wirt soils along drainageways. These soils formed in alluvium. They are more sandy than the Grayford soil. Included soils make up 5 to 10 percent of the map unit.

Available water capacity and permeability are moderate in the Grayford soil. Surface runoff is very rapid. Because of the severe erosion, organic matter content is low in the surface layer and natural fertility is reduced. The surface layer is dominantly strongly acid unless limed.

Most areas are used for hay and pasture. Some are idle. A few small areas are used for cultivated crops.

This soil generally is unsuited to cultivated crops because of the slope and a severe hazard of erosion. Small grain is occasionally grown so that stands of grasses and legumes can be reestablished.

This soil is suited to grasses and legumes for pasture, but it is poorly suited to hay because of the slope and the hazard of erosion. Growing grasses and legumes for pasture is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage

yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, additions of lime and fertilizer, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the slope and the shrink-swell potential, this soil is limited as a site for dwellings. The depth of bedrock also is a limitation on sites for dwellings with basements. Overcoming this limitation generally is expensive. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The dwellings should be designed so that they conform to the natural slope of the land. The soil is severely limited as a site for local roads and streets because of the slope and frost action. Replacing or covering the upper soil layers with suitable base material helps to prevent the road damage caused by frost action. Building roads on the contour and land shaping help to overcome the slope.

This soil is limited as a septic tank absorption field because of the slope, the moderate permeability, and the depth to bedrock. Land shaping and installation of the distribution lines across the slope generally are needed before the absorption field can function properly. Providing suitable fill material helps to overcome the moderate permeability. Filling or mounding the site with suitable filtering material helps to overcome the limited depth to bedrock.

The land capability classification is VIe. The woodland ordination symbol is 1a.

Ha—Haymond silt loam, occasionally flooded. This nearly level, deep, well drained soil is on bottom land along the major streams. It is occasionally flooded for brief periods in winter and early in spring. Areas are narrow and extend for long distances along the streams. They are 5 to 100 acres in size. The dominant size is about 30 acres.

In a typical profile, the surface layer is about 10 inches of dark brown silt loam. The subsoil is dark yellowish brown and dark brown, friable silt loam about 33 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown and dark brown silt loam. In some areas sand and gravel are at a depth of about 40 inches. In other areas gray mottles are within a depth of 20 inches. In places the surface layer and subsoil contain more sand.

Included with this soil in mapping are small areas of the moderately well drained Pekin soils on stream terraces. These soils have a fragipan. They make up 5 to 10 percent of the map unit.

Available water capacity is very high in the Haymond soil, and permeability is moderate. Surface runoff is slow. Organic matter content is moderate in the surface layer. This layer is neutral to medium acid. It is friable and can be easily worked.

Most areas are used for cultivated crops. Some are used for hay and pasture.

This soil is well suited to corn and soybeans. It is not suited to small grain, however, because of the severe crop damage caused by floodwater. A cover of crop residue, cover crops, and green manure crops improve or maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Alfalfa is subject to severe damage during periods of flooding. Overgrazing or trampling by livestock when the soil is wet damages the sod, reduces plant density and forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, additions of lime and fertilizer, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because the occasional flooding is a severe hazard, this soil generally is unsuitable as a site for dwellings, local roads and streets, and septic tank absorption fields. Unless the soil is protected from flooding, alternative sites for these uses should be selected.

The land capability classification is IIw. The woodland ordination symbol is 1a.

HkC2—Hickory silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, well drained soil is on narrow summits and shoulder slopes in the uplands. Areas are narrow and irregularly shaped and are 5 to 40 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is about 6 inches of dark grayish brown silt loam mixed with a small amount of yellowish brown silt loam. The subsoil is about 57 inches thick. The upper part is yellowish brown, friable silt loam; the next part is strong brown, firm clay loam; and the lower part is strong brown, mottled, firm clay loam. The substratum to a depth of 80 inches is yellowish brown, calcareous clay loam. In some areas the loess is more than 20 inches thick. In a few small areas the surface layer and subsoil contain less sand and more clay.

Included with this soil in mapping, on summits and the upper back slopes, are small areas of Cincinnati soils,

which have a fragipan. These soils make up 5 to 10 percent of the map unit.

Available water capacity is high in the Hickory soil, and permeability is moderate. Surface runoff is medium. Organic matter content is low in the surface layer. This layer is dominantly strongly acid unless limed. It is friable and can be easily worked.

Most areas are used as woodland. Some are used for hay and pasture. A few small areas are used for cultivated crops.

This soil is suited to corn, soybeans, and small grain. Erosion is the major hazard. Measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential and the slope, this soil is moderately limited as a site for dwellings. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The dwellings should be designed so that they conform to the natural slope of the land. The soil is severely limited as a site for local roads and streets because of low strength. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Because of the slope, cutting and filling are needed and the roads should be built on the contour if possible.

This soil is moderately limited as a septic tank absorption field because of the moderate permeability and the slope. Land shaping and installation of the distribution lines across the slope generally are needed before the absorption field can function properly. Installing the absorption field in suitable fill material helps to overcome the moderate permeability.

The land capability classification is IIIe. The woodland ordination symbol is 1a.

HkC3—Hickory silt loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, deep, well drained soil is on narrow summits and shoulder slopes in the uplands. Areas are narrow and irregularly shaped and are 5 to 20 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is about 5 inches of yellowish brown silt loam mixed with a small amount of dark grayish brown silt loam. The subsoil is about 63 inches thick. The upper part is yellowish brown, firm clay loam; the next part is brownish yellow and yellowish brown, mottled, firm clay loam; and the lower part is yellowish brown, firm loam. The substratum to a depth of 80 inches is yellowish brown, calcareous loam. In some areas the loess is more than 20 inches thick. In other areas the surface layer and subsoil contain less sand and more clay.

Included with this soil in mapping, on summits and the upper back slopes, are small areas of Cincinnati soils, which have a fragipan. These soils make up 5 to 10 percent of the map unit.

Available water capacity is high in the Hickory soil, and permeability is moderate. Surface runoff is rapid. Because of the severe erosion, organic matter content is low in the surface layer and natural fertility is reduced. The surface layer is dominantly strongly acid unless limed.

Most areas are used for hay and pasture or for woodland. Some are used for cultivated crops or are idle.

This soil is poorly suited to corn, soybeans, small grain, and tobacco. Erosion is the major hazard. Measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay and is well suited to pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially

during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential and the slope, this soil is moderately limited as a site for dwellings. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The dwellings should be designed so that they conform to the natural slope of the land. The soil is severely limited as a site for local roads and streets because of low strength. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Because of the slope, cutting and filling are needed and the roads should be built on the contour if possible.

This soil is moderately limited as a septic tank absorption field because of the moderate permeability and the slope. Land shaping and installation of the distribution lines across the slope generally are needed before the absorption field can function properly. Installing the absorption field in suitable fill material helps to overcome the moderate permeability.

The land capability classification is IVe. The woodland ordination symbol is 1a.

HkD2—Hickory silt loam, 12 to 18 percent slopes, eroded. This strongly sloping, deep, well drained soil is on narrow shoulder slopes and back slopes in the uplands. Areas are narrow and irregularly shaped and are 5 to 100 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is about 8 inches of dark grayish brown silt loam mixed with a small amount of yellowish brown silt loam. The subsoil is about 54 inches thick. The upper part is yellowish brown, friable silt loam; the next part is strong brown, firm silty clay loam; and the lower part is strong brown, firm clay loam. In some areas the loess is more than 20 inches thick. In some small areas the surface layer and subsoil contain less sand and more clay.

Included with this soil in mapping, on summits and the upper back slopes, are small areas of Cincinnati soils, which have a fragipan. These soils make up 5 to 10 percent of the map unit.

Available water capacity is high in the Hickory soil, and permeability is moderate. Surface runoff is very rapid. Organic matter content is low in the surface layer. This layer is dominantly strongly acid unless limed. It is friable and can be easily worked.

Most areas are used as woodland. Some are used for hay and pasture. A few small areas are used for cultivated crops.

This soil is poorly suited to corn, soybeans, and small grain. Erosion is the major hazard. Measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay and is well suited to pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. The erosion hazard, the equipment limitation, and plant competition are the main management concerns. Because of the erosion hazard, the grade of logging roads, skid trails, and landings should be gentle and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. The use of crawler tractors and methods of logging uphill with cables may be needed because of the slope. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the slope, this soil is severely limited as a site for dwellings. The site can be graded so that the slope is modified. The dwellings should be designed so that they conform to the natural slope of the land. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. This soil is severely limited as a site for local roads and streets because of the slope and low strength. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Cutting and filling are needed, and the roads should be built on the contour if possible.

This soil is severely limited as a septic tank absorption field because of the slope. Land shaping and installation of the distribution lines across the slope generally are needed before the absorption field can function properly. Because of the moderate permeability, suitable fill material is needed.

The land capability classification is IVe. The woodland ordination symbol is 1r.

HkD3—Hickory silt loam, 12 to 18 percent slopes, severely eroded. This strongly sloping, deep, well drained soil is on narrow shoulder slopes and back

slopes in the uplands. Areas are narrow and irregularly shaped and are 5 to 60 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is about 3 inches of dark yellowish brown silt loam mixed with yellowish brown clay loam. It is dominantly subsoil material. The subsoil is clay loam about 58 inches thick. The upper part is strong brown and firm or very firm, and the lower part is strong brown, mottled, and firm. The substratum to a depth of 80 inches is yellowish brown and brown, friable, calcareous loam. In places the surface layer and subsoil contain less sand and more clay.

Included with this soil in mapping, on summits and the upper back slopes, are small areas of Cincinnati soils, which have a fragipan. These soils make up 5 to 10 percent of the map unit.

Available water capacity is high in the Hickory soil, and permeability is moderate. Surface runoff is very rapid. Because of the severe erosion, organic matter content is low in the surface layer and natural fertility is reduced. The surface layer is dominantly strongly acid unless limed.

Most areas are used for hay and pasture or for woodland. Some are idle. A few small areas are used for cultivated crops.

This soil generally is unsuited to row crops because of the slope and a severe hazard of erosion. Small grain is occasionally grown so that stands of grasses and legumes can be reestablished.

This soil is suited to grasses and legumes for pasture, but it is poorly suited to hay because of the slope and the erosion hazard. Growing grasses and legumes for pasture is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. The erosion hazard, the equipment limitation, and plant competition are the main management concerns. Because of the erosion hazard, the grade of logging roads, skid trails, and landings should be gentle and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. The use of crawler tractors and methods of logging uphill with cables may be needed because of the slope. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the slope, this soil is severely limited as a site for dwellings. The site can be graded so that the slope is modified. The dwellings should be designed so that they conform to the natural slope of the land. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The soil is severely limited as a site for local roads and streets because of the slope and low strength. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Cutting and filling are needed, and the roads should be built on the contour if possible.

This soil is severely limited as a septic tank absorption field because of the slope. Land shaping and installation of the distribution lines across the slope generally are needed before the absorption field can function properly. Because of the moderate permeability, suitable fill material is needed.

The land capability classification is VIe. The woodland ordination symbol is 1r.

HkE—Hickory silt loam, 18 to 45 percent slopes. This moderately steep to very steep, deep, well drained soil is on back slopes in the uplands. Areas are narrow and irregularly shaped and are 10 to 60 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 2 inches thick. The subsurface layer is yellowish brown silt loam about 2 inches thick. The subsoil is about 50 inches thick. The upper part is yellowish brown, friable silt loam; the next part is yellowish brown and strong brown, firm clay loam; and the lower part is dark yellowish brown and yellowish brown, firm clay loam. The substratum to a depth of 60 inches is dark yellowish brown, firm loam. In some places the surface soil and subsoil contain less sand and more clay.

Included with this soil in mapping, on summits and the upper back slopes, are small areas of Cincinnati soils, which have a fragipan. These soils make up 5 to 10 percent of the map unit.

Available water capacity is high in the Hickory soil, and permeability is moderate. Surface runoff is very rapid. Organic matter content is low in the surface layer. This layer is dominantly neutral.

Most areas are used as woodland. Some are used for hay and pasture. A few are idle.

Because of the slope and a severe hazard of erosion, this soil generally is unsuited to cultivated crops and is poorly suited to hay. It is suited to grasses and legumes for pasture. Growing grasses and legumes for pasture is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. The erosion hazard, the equipment limitation, and plant competition are the main management concerns. Because of the erosion hazard, the grade of logging roads, skid trails, and landings should be gentle and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. Special logging methods, such as yarding logs uphill with a cable, may be needed to minimize the use of rubber-tired skidders and crawler tractors. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on these slopes. Seedlings survive and grow well if competing vegetation is controlled and livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the slope, this soil is severely limited as a site for dwellings. The site can be graded so that the slope is modified. The dwellings should be designed so that they conform to the natural slope of the land. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent structural damage caused by shrinking and swelling. The soil is severely limited as a site for local roads and streets because of the slope and low strength. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Cutting and filling are needed, and the roads should be built on the contour if possible.

This soil is severely limited as a septic tank absorption field because of slope. Operating machinery and digging trenches are very difficult on these slopes. Alternative sites should be selected unless a sanitary sewer system is available.

The land capability classification is VIe. The woodland ordination symbol is 1r.

Ho—Holton loam, occasionally flooded. This nearly level, deep, somewhat poorly drained soil is on bottom land. Areas are narrow and elongated and are 5 to 100 acres in size. The dominant size is about 40 acres.

In a typical profile, the surface layer is about 8 inches of grayish brown loam. The subsoil is about 24 inches thick. The upper part is dark brown, friable loam; the next part is grayish brown, mottled, friable loamy sand; and the lower part is dark gray, friable fine sandy loam. The substratum to a depth of about 60 inches is dark gray, mottled sandy loam and sandy clay loam. In some small areas the surface layer is sandy loam. In some areas the surface layer and subsoil contain more silt and less sand. In other areas the content of coarse fragments is as much as 35 percent below a depth of 40 inches.

Included with this soil in mapping, on the lower back slopes, are small areas of the well drained Cincinnati soils, which have a fragipan. These soils make up 5 to 10 percent of the map unit.

Available water capacity is high in the Holton soil, and permeability is moderate. Surface runoff is slow. A seasonal high water table is at a depth of 1 to 3 feet. Organic matter content is low in the surface layer. This layer is slightly acid or neutral. It is friable and can be easily worked.

Most areas are used for hay or pasture. Some are used for cultivated crops.

If a suitable drainage system is established and maintained, this soil is suited to corn and soybeans. It is not suited to small grain, however, because of the severe crop damage caused by floodwater. The wetness is the major limitation, and the flooding is the major hazard. Tile and shallow surface drains help to remove excess surface water. A conservation tillage system that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain or improve organic matter content and tilth.

This soil is well suited to grasses and legumes for hay and pasture. Alfalfa is subject to severe damage during periods of flooding. Overgrazing or trampling by livestock when the soil is wet damages the sod, reduces plant density and forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, additions of lime and fertilizer, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Water-tolerant species are favored in timber stands. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because the flooding and the wetness are severe limitations, this soil generally is unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads and streets because of the flooding and frost action. Installing a drainage system helps to prevent the road damage caused by frost action. Unless the soil is protected from flooding, alternative sites should be selected.

The land capability classification is IIw. The woodland ordination symbol is 2a.

Hu—Huntington silt loam, occasionally flooded. This nearly level, deep, well drained soil is on bottom land along the Ohio River and its larger tributaries. It is occasionally flooded in winter and early in spring. The areas along the Ohio River are adjacent to the river channel. Those along the smaller streams are at the highest level of the bottom land, adjacent to terraces or uplands. Areas are narrow and elongated and are 30 to 300 acres in size. The dominant size is about 100 acres.

In a typical profile (fig. 12), the surface layer is about 17 inches of dark brown silt loam. The subsoil is firm

silty clay loam about 40 inches thick. The upper part is dark brown, and the lower part is dark yellowish brown. The substratum to a depth of 60 inches is yellowish brown, mottled, firm silty clay loam. Some areas have received an overwash of moderately dark material. In some small areas the content of sand and coarse silt is higher. In a few areas coarse fragments are in the lower part of the subsoil.

Included with this soil in mapping are small areas of Elkinsville, Pate, and Wirt soils. Elkinsville soils are on stream terraces. They formed in loess and in the underlying stratified silty or loamy material. Pate soils are on the lower foot slopes. They formed in material weathered from interbedded limestone and calcareous shale. Wirt soils formed in silty and loamy alluvium near the stream channels. Included soils make up 5 to 10 percent of the map unit.

Available water capacity is very high in the Huntington soil, and permeability is moderate. Surface runoff is medium. A seasonal high water table is at a depth of 4 to 6 feet. Natural fertility is high, and organic matter content is moderate in the surface layer. This layer is slightly acid to mildly alkaline. It is friable and can be easily worked.

Most areas are used for cultivated crops (fig. 13). Some are used for hay and pasture.

This soil is well suited to corn and soybeans. It is not suited to small grain, however, because of the severe crop damage caused by floodwater. The main hazard is the occasional flooding. Crop residue management, cover crops, and green manure crops improve or maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Alfalfa is subject to severe damage by the flooding. Overgrazing or trampling by livestock when the soil is wet damages the sod, reduces plant density and forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedlings survive and grow well if competing vegetation is controlled and livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by good site preparation or by spraying, cutting, or girdling.

Because the occasional flooding is a severe hazard, this soil generally is unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads and streets because of the flooding and frost action. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by floodwater and frost action.

The land capability classification is IIw. The woodland ordination symbol is 1a.

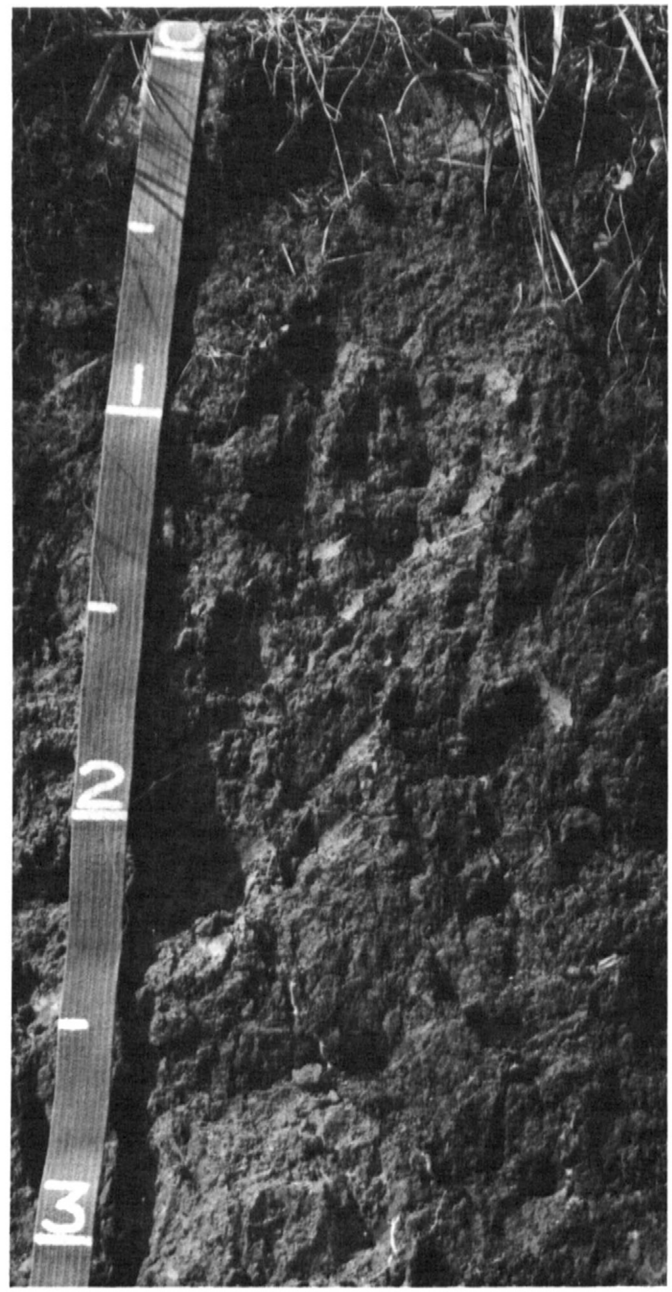


Figure 12.—Profile of Huntington silt loam, occasionally flooded. Depth is marked in feet.

JnB2—Jennings silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, moderately well drained soil is on narrow summits and shoulder slopes in the uplands. Areas are narrow, elongated, and irregularly shaped and are 5 to 150 acres in size. The dominant size is about 20 acres.

Figure 13.—An area of Huntington silt loam, occasionally flooded, used for corn and tobacco. Markland soils are on the escarpment.

In a typical profile, the surface layer is about 8 inches of dark yellowish brown silt loam mixed with a small amount of strong brown silty clay loam. The subsoil is about 54 inches thick. The upper part is strong brown and yellowish brown, friable silty clay loam and silt loam; the next part is a yellowish brown, mottled, very firm silt loam and silty clay loam fragipan; and the lower part is strong brown, firm silty clay. The substratum is brownish yellow, firm silty clay loam. Black shale bedrock is at a depth of about 68 inches. In places the depth to bedrock is more than 6 feet.

Included with this soil in mapping, on summits, shoulder slopes, and back slopes at the lower elevations, are small areas of Deputy soils and the well drained Trappist soils. These soils formed in loess and shale residuum. They make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Jennings soil. Permeability is very slow in and below the fragipan. Surface runoff is medium. A perched seasonal high water table is at a depth of 2 to 3 feet. Organic matter content is low in the surface layer. The fragipan restricts root penetration. The surface layer is dominantly strongly acid unless limed. It is friable and can be easily worked.

Most areas are used for hay and pasture. Some are used for cultivated crops. A few are used for urban development or for woodland.

This soil is well suited to corn, soybeans, small grain, and tobacco. The slowly permeable fragipan is the main limitation, and erosion is the major hazard. Measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content. A subsurface drainage system is needed in seepy areas in some of the drainageways.

This soil is well suited to grasses and legumes for hay and pasture. The growth of deep-rooted legumes, such

as alfalfa, is restricted, however, by the very slowly permeable fragipan. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees. Seedlings survive and grow well if competing vegetation is controlled and livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the wetness, this soil is severely limited as a site for dwellings with basements. It is moderately limited as a site for dwellings without basements because of the wetness and the shrink-swell potential. Installing subsurface drains can help to lower the water table. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The soil is severely limited as a site for local roads and streets because of low strength and frost action. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Frost action can be controlled by replacing or covering the upper soil layers with suitable base material.

This soil is severely limited as a septic tank absorption field because of the very slow permeability and the wetness. Installing the absorption field in suitable fill material helps to overcome the restricted permeability. Providing suitable fill material also helps to overcome the wetness.

The land capability classification is IIe. The woodland ordination symbol is 3a.

JnC2—Jennings silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, moderately well drained soil is on narrow summits, shoulder slopes, and back slopes in the uplands. Areas are narrow and elongated and are 6 to 100 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is about 7 inches of dark brown silt loam mixed with a small amount of yellowish brown silty clay loam. The subsoil is about 40 inches thick. The upper part is yellowish brown, mottled, firm silty clay loam; the next part is a yellowish brown, mottled, very firm loam and clay loam fragipan; and the lower part is strong brown, mottled, very firm silty clay. The substratum is brown, mottled shaly silty clay. Black shale bedrock is at a depth of about 58 inches. In places the depth to bedrock is more than 6 feet.

Included with this soil in mapping, on summits, shoulder slopes, and back slopes at the lower elevations, are small areas of Deputy soils and the well drained Trappist soils. These soils formed in loess and shale residuum. They make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Jennings soil. Permeability is very slow in and below the fragipan. Surface runoff is medium. A perched seasonal high water table is at a depth of 2 to 3 feet. Organic matter content is low in the surface layer. The fragipan restricts root penetration. The surface layer is dominantly strongly acid unless limed. It is friable and can be easily worked.

Most areas are used for hay or pasture. Some are used for cultivated crops. Some are used for woodland.

This soil is suited to corn, soybeans, small grain, and tobacco. The slowly permeable fragipan is the main limitation, and erosion is the major hazard. Measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content. A subsurface drainage system is needed in seepy areas in some of the drainageways.

This soil is well suited to grasses and legumes for hay and pasture. The growth of deep-rooted legumes, such as alfalfa, is restricted, however, by the very slowly permeable fragipan. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees. Seedlings survive and grow well if competing vegetation is controlled and livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the wetness, the slope, and the shrink-swell potential, this soil is moderately limited as a site for dwellings without basements. It is severely limited as a site for dwellings with basements because of the wetness. Installing subsurface drains can help to lower the water table. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The site can be graded so that the slope is modified. The dwellings should be designed so that they conform to the natural slope of the land. The soil is severely limited as a site for local roads and streets because of low strength and frost action. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Frost action can be controlled by replacing or covering

the upper soil layers with suitable base material. Because of the slope, cutting and filling are needed and the roads should be built on the contour if possible.

This soil is severely limited as a septic tank absorption field because of the very slow permeability and the wetness. Installing the absorption field in suitable fill material helps to overcome the restricted permeability. Providing suitable fill material also helps to overcome the wetness.

The land capability classification is IIIe. The woodland ordination symbol is 3a.

JnC3—Jennings silt loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, deep, moderately well drained soil is on narrow summits, shoulder slopes, and back slopes in the uplands. Areas are narrow and elongated and are 6 to 60 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is about 6 inches of yellowish brown silt loam mixed with strong brown silty clay loam. It is dominantly subsoil material. The subsoil is about 59 inches thick. The upper part is strong brown, mottled, firm silty clay loam; the next part is a yellowish brown, mottled, very firm clay loam fragipan; and the lower part is strong brown, very firm shaly silty clay. The substratum is dark brown, mottled shaly silty clay. Black shale bedrock is at a depth of about 70 inches. In places the depth to bedrock is more than 6 feet.

Included with this soil in mapping, on summits, shoulder slopes, and back slopes at the lower elevations, are small areas of Deputy soils and the well drained Trappist soils. These soils formed in loess and shale residuum. They make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Jennings soil. Permeability is very slow in and below the fragipan. Surface runoff is medium. A perched seasonal high water table is at a depth of 2 to 3 feet. Because of the severe erosion, organic matter content is low in the surface layer and natural fertility is reduced. The fragipan restricts root penetration. The surface layer is dominantly strongly acid unless limed. It cannot be easily worked.

Most areas are used for cultivated crops. Some are used for hay and pasture.

This soil is poorly suited to corn, soybeans, and small grain. The slowly permeable fragipan and the low available water capacity are the main limitations, and erosion is the major hazard. Measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content. A subsurface drainage system is needed in seepy areas in some of the drainageways.

This soil is suited to grasses for hay and is well suited to pasture. It is not suited to deep-rooted legumes, such as alfalfa, however, because the very slowly permeable fragipan restricts root penetration and the downward movement of water. Growing grasses is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees. Seedlings survive and grow well if competing vegetation is controlled and livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the wetness, the slope, and the shrink-swell potential, this soil is moderately limited as a site for dwellings without basements. It is severely limited as a site for dwellings with basements because of the wetness. Installing subsurface drains can help to lower the water table. Strengthening foundations, footings, and basement walls, installing foundation drains, and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The site can be graded so that the slope is modified. The dwellings should be designed so that they conform to the natural slope of the land. The soil is severely limited as a site for local roads and streets because of low strength and frost action. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Frost action can be controlled by replacing or covering the upper soil layers with suitable base material. Because of the slope, cutting and filling are needed and the roads should be built on the contour if possible.

This soil is severely limited as a septic tank absorption field because of the very slow permeability and the wetness. Installing the absorption field in suitable fill material helps to overcome the restricted permeability. Providing suitable fill material also helps to overcome the wetness.

The land capability classification is IVe. The woodland ordination symbol is 3a.

MaB2—Markland silt loam, 1 to 6 percent slopes, eroded. This gently sloping, deep, well drained and moderately well drained soil is on narrow, convex slopes and slope breaks on lacustrine terraces. Areas are irregularly shaped and are 5 to 60 acres in size. The dominant size is about 40 acres.

In a typical profile, the surface layer is about 7 inches of dark grayish brown silt loam mixed with a small amount of yellowish brown silty clay loam. The subsoil is

about 29 inches of yellowish brown, mottled, firm and very firm silty clay and clay. The substratum to a depth of 60 inches is yellowish brown and light brownish gray, mottled, very firm silty clay and silty clay loam. In some areas the depth to carbonates is more than 44 inches. In places the loess is more than 15 inches thick.

Included with this soil in mapping are small areas of well drained soils that formed in alluvium on bottom land. These soils make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Markland soil, and permeability is slow. Surface runoff is medium. Organic matter content is moderate in the surface layer. This layer is dominantly medium acid unless limed. It is friable and can be easily worked.

Most areas are used for hay and pasture. Some are used for cultivated crops. A few are used for urban development.

This soil is suited to corn, soybeans, small grain, and tobacco. Erosion is the major hazard. Measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedling mortality and the windthrow hazard are the main management concerns. Selecting proper planting stock and limited overstocking help to overcome seedling mortality. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled and livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential, this soil is severely limited as a site for dwellings. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The soil is severely limited as a site for local roads and streets because of low strength and shrinking and swelling. The base material can be strengthened or replaced with better suited material that can support vehicular traffic.

This soil is severely limited as a septic tank absorption field because of the slow permeability and the wetness. Installing the absorption field in suitable fill material helps to overcome the restricted permeability. Providing suitable fill material also helps to overcome the wetness.

The land capability classification is IIIe. The woodland ordination symbol is 2c.

MaC2—Markland silt loam, 8 to 15 percent slopes, eroded. This moderately sloping, deep, well drained and moderately well drained soil is on the sides of lacustrine terraces. Areas are narrow and irregularly shaped and are 10 to 40 acres in size. The dominant size is about 30 acres.

In a typical profile, the surface layer is about 7 inches of dark grayish brown silt loam mixed with a small amount of light olive brown silty clay loam. The subsoil is about 29 inches thick. It is mottled and firm. The upper part is light olive brown silty clay loam, and the lower part is yellowish brown silty clay. The substratum to a depth of 60 inches is grayish brown, very firm silty clay. In some areas carbonates are within 20 inches of the surface. In other areas they are at a depth of more than 44 inches.

Included with this soil in mapping are small areas of well drained soils that formed in alluvium on bottom land. These soils make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Markland soil, and permeability is slow. Surface runoff is rapid. Organic matter content is moderate in the surface layer. This layer is dominantly medium acid unless limed. It is friable and can be easily tilled.

Most areas are used for hay and pasture. Some are used for cultivated crops or are idle.

This soil is poorly suited to corn, soybeans, small grain, and tobacco. Erosion is the major hazard. Measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay and is well suited to pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedling mortality and the windthrow hazard are the main management concerns. Selecting proper planting stock and limited overstocking help to overcome seedling mortality. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled and livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential, this soil is severely limited as a site for dwellings. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The soil is severely limited as a site for local roads and streets because of low strength and shrinking and swelling. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Because of the slope, cutting and filling are needed and the roads should be built on the contour if possible.

This soil is severely limited as a septic tank absorption field because of the slow permeability and the wetness. Installing the absorption field in suitable fill material helps to overcome the restricted permeability. Providing suitable fill material also helps to overcome the wetness.

The land capability classification is IVe. The woodland ordination symbol is 2c.

NeB2—Negley silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on loess-covered valley trains near the major streams. Areas are narrow and irregularly shaped and are 5 to 50 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is about 7 inches of dark brown silt loam mixed with a small amount of strong brown subsoil material. The subsoil extends to a depth of 80 inches. The upper part is strong brown, friable silt loam and loam; the next part is yellowish red, firm clay loam; and the lower part is red, firm clay loam and sandy clay loam. In rolling areas silty deposits of local alluvium are in depressions. In some areas the soil is underlain by limestone bedrock. In other areas the surface layer and subsoil are yellower.

Included with this soil in mapping are small areas of Wirt soils, which formed in silty and loamy alluvium on bottom land. These soils make up 5 to 8 percent of the map unit.

Available water capacity is high in the Negley soil, and permeability is moderate. Surface runoff is medium. Organic matter content is moderate in the surface layer. This layer is dominantly strongly acid unless limed. It is friable and can be easily worked.

Most areas are used for cultivated crops. A few are used for hay and pasture or for woodland.

This soil is well suited to corn, soybeans, small grain, and tobacco. Erosion is the major hazard. One or more measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, or grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, additions of lime and fertilizer, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Limitations are slight if this soil is used as a site for dwellings or septic tank absorption fields. Frost action is a moderate limitation on sites for local roads and streets. It can be controlled by replacing or covering the upper soil layers with suitable base material.

The land capability classification is IIe. The woodland ordination symbol is 1a.

NeC2—Negley silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, well drained soil is on loess-covered valley trains near the major streams. Areas are narrow and irregularly shaped and are 5 to 60 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is about 8 inches of dark yellowish brown silt loam mixed with a small amount of strong brown silt loam. The subsoil extends to a depth of 80 inches. The upper part is strong brown, friable silt loam and silty clay loam, and the lower part is yellowish red, firm clay loam. In some areas the soil is underlain by limestone bedrock. In rolling areas silty deposits of local alluvium are in depressions. In places the surface layer and subsoil are yellower.

Included with this soil in mapping are small areas of Wirt soils, which formed in silty and loamy alluvium on bottom land. These soils make up 5 to 8 percent of the map unit.

Available water capacity is high in the Negley soil, and permeability is moderate. Surface runoff is rapid. Organic matter content is moderate in the surface layer. This

layer is dominantly strongly acid unless limed. It is friable and can be easily tilled.

Most areas are used for hay and pasture. Some are used for cultivated crops, are idle, or are used as woodland.

This soil is suited to corn, soybeans, small grain, and tobacco. Erosion is the major hazard. One or more measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, additions of lime and fertilizer, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the slope, this soil is moderately limited as a site for dwellings. The site can be graded so that the slope is modified. The dwellings should be designed so that they conform to the natural slope of the land. The soil is moderately limited as a site for local roads and streets because of frost action and the slope. Frost action can be controlled by replacing or covering the upper soil layers with suitable base material. Because of the slope, cutting and filling are needed and the roads should be built on the contour if possible.

This soil is moderately limited as a septic tank absorption field because of the slope. Land shaping and installation of the distribution lines across the slope generally are needed before the absorption field can function properly.

The land capability classification is IIIe. The woodland ordination symbol is 1a.

NnB2—Nicholson silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, moderately well drained soil is on narrow summits and shoulder slopes between nearly level areas and sloping hillsides on uplands. Areas are irregularly shaped and are 5 to 150 acres in size. The dominant size is about 40 acres.

In a typical profile, the surface layer is about 8 inches of dark yellowish brown silt loam mixed with a small amount of yellowish brown silty clay loam. The subsoil is about 53 inches thick. The upper part is yellowish brown, friable silty clay loam; the next part is a yellowish brown, very firm silty clay loam fragipan; and the lower part is yellowish brown, very firm clay. The substratum is grayish brown, firm silty clay loam. Limestone and shale bedrock is at a depth of about 72 inches. In places the soil is well drained and moderately well drained and formed in silty material, in a thin layer of clayey glacial drift, and in the underlying clay residuum.

Included with this soil in mapping, on shoulder slopes and back slopes, are small areas of the well drained Switzerland soils, which do not have a fragipan. These soils make up 5 to 8 percent of the map unit.

Available water capacity is moderate in the Nicholson soil, and permeability is slow. Surface runoff is medium. A perched seasonal high water table is at a depth of 1.5 to 2.5 feet during a significant part of the year. Organic matter content is moderate in the surface layer. The fragipan restricts root penetration. The surface layer is dominantly strongly acid unless limed. It is friable and can be easily worked.

Most areas are used for hay or pasture. Some are used for cultivated crops. A few are used for urban development or for woodland.

This soil is well suited to corn, soybeans, small grain, and tobacco. The slowly permeable fragipan is the main limitation, and erosion is the major hazard. Measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content. A subsurface drainage system is needed in seepy areas in some of the drainageways.

This soil is well suited to grasses and legumes for hay and pasture. The growth of deep-rooted legumes, such as alfalfa, is restricted, however, by the slowly permeable fragipan. Growing grasses and legumes for hay and pasture is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can

be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the wetness, this soil is moderately limited as a site for dwellings without basements and severely limited as a site for dwellings with basements. Subsurface drains can help to lower the water table. The soil is severely limited as a site for local roads and streets because of low strength. The base material can be strengthened or replaced with better suited material that can support vehicular traffic.

This soil is severely limited as a septic tank absorption field because of the slow permeability and the wetness. Installing the absorption field in suitable fill material helps to overcome the restricted permeability. Providing suitable fill material also helps to overcome the wetness.

The land capability classification is IIe. The woodland ordination symbol is 2a.

PeE—Pate silty clay loam, 18 to 35 percent slopes. This moderately steep and steep, deep, well drained soil is on foot slopes in the uplands. Areas are narrow and elongated and are 10 to 70 acres in size.

In a typical profile, the surface layer is about 8 inches of dark brown silty clay loam mixed with a small amount of yellowish brown silty clay loam. The subsoil is about 57 inches thick. The upper part is yellowish brown, firm and very firm, silty clay loam and silty clay; the next part is yellowish brown and light olive brown, very firm clay; and the lower part is light olive brown, very firm flaggy clay. Interbedded limestone and gray calcareous shale are at a depth of about 65 inches. In some areas the surface layer is flaggy silt loam or flaggy silty clay loam. In some small areas the surface soil is 10 to 30 inches of dark brown or dark yellowish brown silt loam. In places the soil is moderately deep.

Included with this soil in mapping are small areas of Dearborn and Huntington soils, which formed in alluvium on bottom land. These soils are less clayey than the Pate soil. They make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Pate soil, and permeability is very slow. Surface runoff is rapid. Organic matter content is moderate in the surface layer. This layer is dominantly slightly acid.

Most areas are used for hay and pasture. Many are idle or are used as woodland.

This soil generally is unsuited to row crops because of the moderately steep and steep slope and a severe hazard of erosion. Small grain is occasionally grown so that stands of grasses and legumes can be reestablished.

This soil is suited to grasses and legumes for permanent pasture. It is poorly suited to hay, however, because of the slope and the erosion hazard. Permanent stands of grasses and legumes, contour and minimum tillage during seedbed preparation, and additions of crop residue help to control surface runoff and erosion. Overgrazing or trampling by livestock when the soil is wet damages the sod, reduces the plant density and forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedling mortality and the windthrow hazard are the main management concerns. Selecting proper planting stock and limited overstocking help to overcome seedling mortality. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling. Special logging methods, such as yarding logs uphill with a cable, may be needed to minimize the use of rubber-tired skidders and crawler tractors. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on these slopes. Because of the erosion hazard, the grade of logging roads, skid trails, and landings should be gentle and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures.

Because the shrink-swell potential and the slope are severe limitations, this soil generally is unsuitable as a site for dwellings. It is severely limited as a site for local roads and streets because of the slope, low strength, and shrinking and swelling. Because of the slope, the roads and streets should be built on the contour if possible and cutting and filling are needed. The base material can be strengthed or replaced with better suited material that can support vehicular traffic.

This soil generally is unsuitable as a septic tank absorption field because the slope and the very slow permeability are severe limitations. Alternative sites should be selected, unless a sanitary sewer system is available.

The land capability classification is VIIe. The woodland ordination symbol is 1r.

PkB—Pekin silt loam, 1 to 4 percent slopes, rarely flooded. This gently sloping, deep, moderately well drained soil is on old stream terraces, which are a few feet higher in elevation than the adjacent alluvial bottom land. The soil is subject to rare flooding of brief duration in winter and in spring. Areas are irregularly shaped and are 5 to 40 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is about 7 inches of dark yellowish brown silt loam. The subsoil is about 50 inches thick. The upper part is yellowish brown, friable silt loam, and the lower part is a yellowish brown, very firm silty clay loam and silt loam fragipan. The substratum to a depth of 60 inches is brownish yellow

silt loam. In places the very firm and brittle layers make up, by volume, less than 60 percent of the subsoil.

Included with this soil in mapping, on terraces near slope breaks and drainageways, are small areas of the well drained Elkinsville soils, which do not have a fragipan. Also included are small areas of the well drained Haymond soils, which formed in silty alluvium on bottom land. Included soils make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Pekin soil. Permeability is very slow in the fragipan. Surface runoff is medium in cultivated areas. A seasonal high water table is at a depth of 2 to 6 feet late in winter and in spring. Organic matter content is moderate in the surface layer. The fragipan restricts root penetration. The surface layer is dominantly strongly acid unless limed. It is friable and can be easily worked.

Most areas are used for cultivated crops. Some are used for hay and pasture or for woodland.

This soil is well suited to corn, soybeans, and small grain. The slope and the very slowly permeable fragipan are the major limitations. Erosion is a hazard in areas where the slope is 2 to 4 percent. A conservation tillage system that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to control erosion and maintain or improve tilth and organic matter content.

This soil is well suited to grasses for hay and pasture. It is poorly suited to deep-rooted legumes, such as alfalfa, however, because the very slowly permeable fragipan restricts root penetration and the downward movement of water. Overgrazing or trampling by livestock when the soil is wet damages the sod, reduces plant density and forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees. Seedlings survive and grow well if competing vegetation is controlled and livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the flooding and the wetness, this soil generally is unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads and streets because of low strength and frost action. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by frost action. The base material can be strengthened or replaced with better suited material that can support vehicular traffic.

The land capability classification is IIe. The woodland ordination symbol is 3a.

Pu—Pits, quarries. This map unit occurs as nearly level to very steep miscellaneous areas where bedrock has been removed for use as construction material. Areas are 5 to 85 acres in size.

In a typical area, the exposed material is limestone bedrock and thin layers of shale bedrock.

Included with this unit in mapping are small areas of rubble and spoil near the edges of the pits. Also included, near the center of the pits, are small areas of water. Included areas make up 5 to 10 percent of the map unit.

Most of the pits are not presently mined. The areas of exposed bedrock and water support no vegetation. Pine seedlings and selected hardwood species can be established on the spoil banks where a sufficient amount of soil material is mixed with the flaggy, channery, and shaly rock fragments.

Onsite investigation is needed if these miscellaneous areas are to be used as building sites.

The land capability classification is VIII. No woodland ordination symbol is assigned.

Ra—Rahm silty clay loam, occasionally flooded. This nearly level, deep, somewhat poorly drained soil is on high bottom land or low terraces along the Ohio River. It is occasionally flooded for brief periods. The flooding commonly occurs in winter and early in spring. Areas generally are broad, but in sloughs and swales they are narrow and elongated. They are 10 to 60 acres in size. The dominant size is about 30 acres.

In a typical profile, the surface layer is about 6 inches of dark grayish brown silty clay loam. The subsurface layer also is dark grayish brown silty clay loam. It is about 4 inches thick. The subsoil is about 68 inches of grayish brown, yellowish brown, and dark yellowish brown, mottled, very firm silty clay and firm silty clay loam. The substratum to a depth of 80 inches is dark yellowish brown, mottled, firm silty clay loam. In some small areas the upper part of the subsoil is more acid. In other small areas the lower part of the subsoil is less acid. In some small areas fine textures are between depths of 10 and 40 inches.

Included with this soil in mapping are small areas of the well drained Huntington soils, which formed in neutral silty alluvium on flood plains. These soils make up 5 to 10 percent of the map unit.

Available water capacity is high in the Rahm soil, and permeability is slow. Surface runoff is slow to ponded. A seasonal high water table is at a depth of 1 to 3 feet during a significant part of the year. Organic matter content is low in the surface layer. This layer is neutral. It is friable and can be easily worked.

Most areas are used for cultivated crops. Some are used for hay and pasture.

If a suitable drainage system is established and maintained, this soil is well suited to corn and soybeans. It generally is unsuited to small grain because of the

severe crop damage caused by floodwater. The wetness is the major limitation, and the flooding is the major hazard. A subsurface drainage system can help to remove excess water, but locating suitable outlets is difficult. A conservation tillage system that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain or improve organic matter content and tilth.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Water-tolerant species are favored in timber stands. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because the occasional flooding and the wetness are severe limitations, this soil generally is unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads and streets because of the occasional flooding, frost action, and low strength. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by flooding and frost action. The base material can be strengthened or replaced with better suited material that can support vehicular traffic.

The land capability classification is IIw. The woodland ordination symbol is 1a.

RoA—Rossmoyne silt loam, 0 to 2 percent slopes. This deep, moderately well drained, nearly level soil is on narrow summits in the uplands. Areas are narrow and irregularly shaped and are 10 to 40 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is about 7 inches of dark brown silt loam. The subsoil extends to a depth of 80 inches. It is yellowish brown. It is, in sequence downward, friable silt loam; mottled, friable silt loam; a mottled, very firm silt loam, loam, and clay loam fragipan; and mottled, firm clay loam. In places the soil is well drained. In some areas it is underlain by interbedded limestone and calcareous shale, and in other areas it is underlain by black shale.

Included with this soil in mapping are small areas of the somewhat poorly drained Avonburg soils on broad summits near tabular divides. These soils make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Rossmoyne soil. Permability is slow in the fragipan. Surface runoff is slow in cultivated areas. A perched seasonal high water table is at a depth of 1.5 to 3.0 feet in winter and spring. Organic matter content is moderate in the surface layer. The fragipan restricts root penetration. The surface layer is dominantly strongly acid unless limed. It is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops. Some are used for hay and pasture. A few small areas are used as woodland.

This soil is well suited to corn, soybeans, small grain, and tobacco. The main limitation is the seasonal high water table. Another limitation is the slowly permeable fragipan. During periods when rainfall is below normal or is poorly distributed, crops can be damaged by drought. A subsurface drainage system that lowers the water table helps to overcome the wetness. Leaving stubble on the surface and adding other organic material conserve moisture. Crop residue management and cover crops improve or maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay and pasture (fig. 14). Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees. Plant competition, the windthrow hazard, and seedling mortality are the main management concerns. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Selecting proper planting stock and limited overstocking help to overcome seedling mortality. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the wetness and the shrink-swell potential, this soil is moderately limited as a site for dwellings without basements. It is severely limited as a site for dwellings with basements because of the wetness. Subsurface drains can help to lower the water table. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The soil is severely limited as a site for local roads and streets because of frost action and low strength. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Frost action can be controlled by replacing or covering the upper soil layers with suitable base material.

This soil is severely limited as a septic tank absorption field because of the slow permeability and the wetness.

Figure 14.—Bales of fescue hay on Rossmoyne silt loam, 0 to 2 percent slopes.

Installing the absorption field in suitable fill material helps to overcome the restricted permeability. Providing suitable fill material also helps to overcome the wetness.

The land capability classification is IIw. The woodland ordination symbol is 3d.

RoB2—Rossmoyne silt loam, 2 to 6 percent slopes, eroded. This deep, moderately well drained, gently sloping soil is on summits, shoulder slopes, and the upper back slopes in the uplands. Areas are narrow and irregularly shaped and are 10 to 60 acres in size. The dominant size is about 40 acres.

In a typical profile, the surface layer is about 8 inches of dark brown silt loam mixed with a small amount of yellowish brown silt loam. The subsoil extends to a depth of 80 inches. It is yellowish brown. It is, in sequence downward, friable silt loam; mottled, friable silt loam; a mottled, very firm and brittle silt loam fragipan; and firm silt loam. In places the soil is well drained. In some areas it is underlain by interbedded limestone and calcareous shale, and in other areas it is underlain by black shale.

Included with this soil in mapping are a few areas of the nearly level, somewhat poorly drained Avonburg soils in the center of the summits. These soils make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Rossmoyne soil. Permeability is slow in the fragipan. Surface runoff is medium in cultivated areas. A perched seasonal high water table is at a depth of 1.5 to 3.0 feet in winter and spring. Organic matter content is moderate in the surface layer. The fragipan restricts root penetration. The surface layer is dominantly strongly acid unless limed. It is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for hay and pasture. Some are used for cultivated crops. A few small areas are used as woodland.

This soil is well suited to corn, soybeans, small grain, and tobacco. Erosion is the major hazard. One or more measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Growing grasses and legumes is effective in controlling soil blowing and erosion. Overgrazing or

grazing when the soil is wet, however, causes surface compaction, excessive surface runoff, and poor tilth. Proper stocking rates, pasture rotation, additions of lime and fertilizer, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees. Plant competition, the windthrow hazard, and seedling mortality are the main management concerns. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Selecting proper planting stock and limited overstocking help to overcome seedling mortality. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the wetness and the shrink-swell potential, this soil is moderately limited as a site for dwellings without basements. It is severely limited as a site for dwellings with basements because of the wetness. Subsurface drains can help to lower the water table. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The soil is severely limited as a site for local roads and streets because of frost action and low strength. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Frost action can be controlled by replacing or covering the upper soil layers with suitable base material.

This soil is severely limited as a septic tank absorption field because of the slow permeability and the wetness. Installing the absorption field in suitable fill material helps to overcome the restricted permeability. Providing suitable fill material also helps to overcome the wetness.

The land capability classification is IIe. The woodland ordination symbol is 3d.

RyA—Ryker silt loam, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on summits in the uplands. Areas are broad and irregularly shaped and are 20 to 80 acres in size. The dominant size is about 40 acres.

In a typical profile, the surface layer is about 6 inches of dark brown silt loam. The subsurface layer is about 6 inches of yellowish brown silt loam. The subsoil extends to a depth of 80 inches. The upper part is yellowish brown silty clay loam and silt loam, and the lower part is yellowish red silty clay loam. In places the depth to bedrock is less than 60 inches. In some areas the surface soil and subsoil have no glacial drift. In other areas the soil is underlain by red gravel.

Included with this soil in mapping, on back slopes at the lower elevations, are small areas of the moderately deep Caneyville soils, which formed in limestone bedrock residuum. These soils make up 5 to 10 percent of the map unit.

Available water capacity is high in the Ryker soil, and permeability is moderate. Surface runoff is slow. Organic matter content is moderate in the surface layer. This layer is strongly acid or medium acid unless limed. It is friable and can be easily worked.

Most areas are used for cultivated crops. Some are used for subdivisions. A few are used for hay and pasture.

This soil is well suited to corn, soybeans, small grain, and tobacco (fig. 15). Crop residue management and cover crops improve or maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, additions of lime and fertilizer, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The soil is severely limited as a site for local roads and streets because of frost action and low strength. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Frost action can be controlled by replacing or covering the upper soil layers with suitable base material.

This soil is moderately limited as a septic tank absorption field because of the moderate permeability. Installing the absorption field in better suited fill material helps to overcome the restricted permeability.

The land capability classification is I. The woodland ordination symbol is 1a.

RyB2—Ryker silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on summits and shoulder slopes in the uplands. Areas are broad and irregularly shaped and are 20 to 80 acres in size. The dominant size is about 40 acres.

In a typical profile, the surface layer is about 8 inches of dark brown silt loam mixed with a small amount of

Figure 15.—Soybeans and tobacco on Ryker silt loam, 0 to 2 percent slopes.

strong brown silty clay loam. The subsoil extends to a depth of 80 inches. The upper part is strong brown and yellowish brown, friable and firm silty clay loam, and the lower part is yellowish red and red, firm silty clay loam. In places the depth to bedrock is less than 60 inches. In some areas the surface layer and subsoil have no glacial drift. In other areas the soil is underlain by red gravel.

Included with this soil in mapping, on back slopes at the lower elevations, are small areas of the moderately deep Caneyville soils, which formed in limestone bedrock residuum. These soils make up 5 to 10 percent of the map unit.

Available water capacity is high in the Ryker soil, and permeability is moderate. Surface runoff is medium. Organic matter content is moderate in the surface layer. This layer is strongly acid or medium acid unless limed. It is friable and can be easily worked.

Most areas are used for cultivated crops. Some are used for subdivisions. A few are used for hay and pasture.

This soil is well suited to corn, soybeans, small grain, and tobacco. Erosion is the major hazard. One or more measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, additions of lime and fertilizer, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The soil is severely limited as a site for local roads and

streets because of frost action and low strength. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Frost action can be controlled by replacing or covering the upper soil layers with suitable base material.

This soil is moderately limited as a septic tank absorption field because of the moderate permeability. Installing the absorption field in better suited fill material helps to overcome the restricted permeability.

The land capability classification is IIe. The woodland ordination symbol is 1a.

RyC2—Ryker silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, well drained soil is on summits, shoulder slopes, and back slopes in the uplands. Areas are narrow and elongated and are 10 to 60 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is about 8 inches of dark brown silt loam mixed with a small amount of yellowish brown silt loam. The subsoil extends to a depth of 80 inches. The upper part is yellowish brown, friable silt loam, and the lower part is strong brown and yellowish red, friable and firm silty clay loam. In places the depth to bedrock is less than 60 inches. In some areas the surface layer and subsoil have no glacial drift. In other areas the soil is underlain by red gravel.

Included with this soil in mapping, on back slopes at the lower elevations, are small areas of the moderately deep Caneyville soils, which formed in limestone bedrock residuum. These soils make up 5 to 10 percent of the map unit.

Available water capacity is high in the Ryker soil, and permeability is moderate. Surface runoff is rapid. Organic matter content is moderate in the surface layer. This layer is strongly acid or medium acid unless limed. It is friable and can be easily worked.

Most areas are used for hay and pasture. Some are used for cultivated crops, are idle, or are used as woodland.

This soil is suited to corn, soybeans, small grain, and tobacco. Erosion is the major hazard. One or more measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, additions of lime and fertilizer, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling. Because of the erosion hazard, the grade of logging roads, skid trails, and landings should be gentle and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures.

Because of the shrink-swell potential and the slope, this soil is moderately limited as a site for dwellings. The site can be graded so that the slope is modified. The dwellings should be designed so that they conform to the natural slope of the land. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The soil is severely limited as a site for local roads and streets because of frost action and low strength. Frost action can be controlled by replacing or covering the upper soil layers with suitable base material. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Because of the slope, cutting and filling are needed and the roads should be built on the contour if possible.

This soil is moderately limited as a septic tank absorption field because of the slope and the moderate permeability. Land shaping and installation of the distribution lines across the slope generally are needed before the absorption field can function properly. Installing the absorption field in better suited fill material helps to overcome the restricted permeability.

The land capability classification is IIIe. The woodland ordination symbol is 1a.

RyC3—Ryker silt loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, deep, well drained soil is on summits, shoulder slopes, and back slopes in the uplands. Areas are narrow and elongated and are 10 to 60 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is about 7 inches of yellowish red silt loam mixed with a small amount of dark brown silt loam. The subsoil extends to a depth of 80 inches. The upper part is yellowish red, firm silty clay loam, and the lower part is yellowish red clay loam. In places the depth to bedrock is less than 60 inches. In some areas the soil is underlain by red gravel.

Included with this soil in mapping, on back slopes at the lower elevations, are small areas of the moderately deep Caneyville soils, which formed in limestone

bedrock residuum. These soils make up 5 to 10 percent of the map unit.

Available water capacity is high in the Ryker soil, and permeability is moderate. Surface runoff is rapid. Organic matter content is low in the surface layer. This layer is dominantly strongly acid unless limed.

Most areas are used for hay and pasture. Some are used for cultivated crops, are idle, or are used as woodland.

This soil is poorly suited to corn, soybeans, small grain, and tobacco. Erosion is the major hazard. One or more measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay and is well suited to pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, additions of lime and fertilizer, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling. Because of the erosion hazard, the grade of logging roads, skid trails, and landings should be gentle and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures.

Because of the shrink-swell potential and the slope, this soil is moderately limited as a site for dwellings. The site can be graded so that the slope is modified. The dwellings should be designed so that they conform to the natural slope of the land. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The soil is severely limited as a site for local roads and streets because of frost action and low strength. Frost action can be controlled by replacing or covering the upper soil layers with suitable base material. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Because of the slope, cutting and filling are needed and the roads should be built on the contour if possible.

This soil is moderately limited as a septic tank absorption field because of the slope and the moderate permeability. Land shaping and installation of the distribution lines across the slope generally are needed before the absorption field can function properly. Installing the absorption field in better suited fill material helps to overcome the restricted permeability.

The land capability classification is IVe. The woodland ordination symbol is 1a.

SwB2—Switzerland silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on summits and shoulder slopes in the uplands. Areas are narrow and elongated and are 5 to 100 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is about 11 inches of dark brown silt loam mixed with a small amount of yellowish brown silty clay loam. The subsoil is about 59 inches thick. The upper part is yellowish brown, firm silty clay loam; the next part is yellowish brown, very firm silty clay and clay; and the lower part is light olive brown, very firm clay. The substratum to a depth of 80 inches is light olive brown, calcareous flaggy clay. In places the soil contains more clay in the surface layer and subsoil and is less than 60 inches deep over bedrock. In some areas gray mottles are in the upper part of the profile.

Included with this soil in mapping, near the center of the summits, are small areas of the moderately well drained Nicholson soils, which have a fragipan. These soils make up 5 to 10 percent of the map unit.

Available water capacity is high in the Switzerland soil. Permeability is moderate in the upper part of the subsoil and very slow in the lower part. Surface runoff is medium. Organic matter content is moderate in the surface layer. This layer is dominantly strongly acid unless limed. It is friable and can be easily worked.

Most areas are used for hay and pasture. Some are used for cultivated crops, are idle, or are used as woodland.

This soil is well suited to corn, soybeans, small grain, and tobacco. Erosion is the major hazard. Measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely

grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential, this soil is severely limited as a site for dwellings with basements and is moderately limited as a site for dwellings without basements. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The soil is severely limited as a site for local roads and streets because of frost action and low strength. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Frost action can be controlled by replacing or covering the upper soil layers with suitable base material.

This soil is severely limited as a septic tank absorption field because of the very slow permeability in the lower part of the subsoil. Installing the absorption field in better suited fill material helps to overcome the restricted permeability.

The land capability classification is IIe. The woodland ordination symbol is 1a.

SxC2—Switzerland-Carmel silt loams, 2 to 12 percent slopes, eroded. These deep, well drained soils are on uplands. The gently sloping Switzerland soil is in areas near the center of summits and on back slopes where the mantle of loess is thicker. The moderately sloping Carmel soil is in areas on the edges of summits, on shoulder slopes, and on back slopes where the loess mantle is thin and the underlying calcareous shale and limestone are closer to the surface. Areas are elongated and irregularly shaped and are 10 to 50 acres in size. They are about 45 percent Switzerland soil and 40 percent Carmel soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

In a typical profile of the Switzerland soil, the surface layer is about 5 inches of dark yellowish brown silt loam mixed with a small amount of yellowish brown subsoil material. The subsoil is about 48 inches thick. The upper part is yellowish brown, friable silt loam and strong brown, firm silty clay loam, and the lower part is yellowish brown, mottled, very firm silty clay and clay. The substratum to a depth of about 60 inches is olive yellow silty clay. In places gray mottles are in the upper part of the profile.

In a typical profile of the Carmel soil, the surface layer is about 5 inches of dark yellowish brown silt loam mixed with a small amount of yellowish brown subsoil material. The subsoil is about 32 inches thick. The upper part is yellowish brown, mottled, firm silty clay loam, and the lower part is light olive brown, very firm silty clay. The substratum is olive yellow clay. Interbedded calcareous shale and limestone are at a depth of about 48 inches. In places the depth to bedrock is less than 40 inches.

Included with these soils in mapping, near the center of the summits, are small areas of the moderately well drained Nicholson soils, which have a fragipan. These included soils make up about 15 percent of the map unit.

Available water capacity is moderate in the Carmel and Switzerland soils. Permeability is moderate in the upper part of the subsoil in the Switzerland soil and very slow in the lower part. It is very slow in the Carmel soil. Surface runoff is rapid on both soils. Organic matter content is moderate in the surface layer. This layer is strongly acid unless limed.

Most areas are used for hay and pasture. Some are used for cultivated crops, are idle, or are used as woodland.

These soils are suited to corn, soybeans, small grain, and tobacco. Erosion is the major hazard. Measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

These soils are well suited to grasses and legumes for hay and pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

These soils are well suited to trees. Plant competition is the main management concern. Seedling mortality and the windthrow hazard also are concerns in managing the Carmel soil. Selecting proper planting stock and limited overstocking help to overcome seedling mortality. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential, these soils are limited as sites for dwellings. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The soils are severely

limited as sites for local roads and streets because of low strength. Frost action in the Switzerland soil and the shrink-swell potential of the Carmel soil also are severe limitations. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Frost action can be controlled by replacing or covering the upper soil layers with suitable base material.

These soils are severely limited as septic tank absorption fields because of the very slow permeability. Installing the absorption field in suitable fill material helps to overcome the restricted permeability.

The land capability classification is IIIe. The Switzerland soil has woodland ordination symbol 1a and the Carmel soil has woodland ordination symbol 1c.

TrC2—Trappist silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, moderately deep, well drained soil is on summits, shoulder slopes, and back slopes in the uplands. Areas are narrow and irregularly shaped and are 5 to 60 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is about 6 inches of dark brown silt loam mixed with a small amount of strong brown silty clay loam. The subsoil is about 25 inches thick. The upper part is strong brown, friable and firm silty clay loam, and the lower part is yellowish brown and light yellowish brown, firm silty clay and silty clay loam. The substratum is light brownish gray, firm shaly silty clay loam. Hard black shale bedrock is at a depth of about 38 inches. In places the depth to black shale is more than 40 inches.

Included with this soil in mapping, on summits, shoulder slopes, and back slopes at the higher elevations, are small areas of the moderately well drained Jennings soils, which have a fragipan. These soils make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Trappist soil, and permeability is slow. Surface runoff is rapid. Organic matter content is moderate in the surface layer. This layer is dominantly strongly acid unless limed. It is friable and can be easily worked.

Most areas are used for pasture and hay. Some are used as woodland. A few are used for cultivated crops.

This soil is suited to corn, soybeans, and small grain. Erosion is the major hazard. Measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees. Seedling mortality and plant competition are the main management concerns. Selecting special planting stock and overstocking help to overcome seedling mortality. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential, the slope, and the depth to bedrock, this soil is moderately limited as a site for dwellings without basements. It is severely limited as a site for dwellings with basements because of the depth to bedrock. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The dwellings should be designed so that they conform to the natural slope of the land. The depth to bedrock also should be considered when the dwellings are designed. The soil is severely limited as a site for local roads and streets because of low strength. The base material can be strengthened or replaced with better suited material that can support vehicular traffic.

This soil is severely limited as a septic tank absorption field because of the slow permeability and the depth to bedrock. Installing the absorption field in better suited fill material helps to overcome the restricted permeability. The depth to bedrock can be increased by filling or mounding the site with suitable filtering material.

The land capability classification is IIIe. The woodland ordination symbol is 3c.

TrD2—Trappist silt loam, 12 to 18 percent slopes, eroded. This strongly sloping, moderately deep, well drained soil is on back slopes in the uplands. Areas are narrow and irregularly shaped and are 5 to 80 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is about 5 inches of dark brown silt loam mixed with a small amount of yellowish brown silt loam. The subsoil is about 20 inches thick. The upper part is yellowish brown, friable silt loam, and the lower part is strong brown, mottled, firm silty clay loam. The substratum is brown, mottled shaly silty clay loam. Hard black shale bedrock is at a depth of about 38 inches. In some areas the depth to black shale is more than 40 inches. In other areas the depth to bedrock is less than 20 inches.

Included with this soil in mapping, on summits, shoulder slopes, and back slopes at the higher

elevations, are small areas of the moderately well drained Jennings soils, which have a fragipan. These soils make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Trappist soil, and permeability is slow. Surface runoff is very rapid. Organic matter content is moderate in the surface layer. This layer is strongly acid unless limed. It is friable and can be easily worked.

Most areas are used for woodland or for hay and pasture. A few small areas are used for cultivated crops.

This soil is poorly suited to corn, soybeans, and small grain. Erosion is the major hazard. Measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay and is well suited to pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees. The equipment limitation and the erosion hazard are the main management concerns. When the soil is wet, logging roads tend to be slippery and ruts form quickly. Because of the erosion hazard, the grade of logging roads, skid trails, and landings should be gentle and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. Seedlings survive and grow well if competing vegetation is controlled and livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the slope, this soil is severely limited as a site for dwellings without basements. It is severely limited as a site for dwellings with basements because of the slope and the depth to bedrock. The site can be graded so that the slope is modified. The dwellings should be designed so that they conform to the natural slope of the land. The depth to bedrock also should be considered when the dwellings are designed. Strengthening foundations, footings, and basement walls and backfilling with a coarser textured material help to prevent the structural damage caused by shrinking and swelling. The soil is severely limited as a site for local roads and streets because of the slope and low strength. The base material can be strengthened or replaced with better suited material that can support vehicular traffic. Because of the slope, cutting and filling are needed and the roads should be built on the contour if possible.

This soil is severely limited as a septic tank absorption field because of the depth to bedrock, the slope, and the slow permeability. Installing the absorption field in better suited fill material helps to overcome the restricted permeability. The depth to bedrock can be increased by filling or mounding the site with suitable filtering material. Land shaping and installation of the distribution lines across the slope generally are needed before the absorption field can function properly.

The land capability classification is IVe. The woodland ordination symbol is 3c.

TtC3—Trappist silty clay loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, moderately deep, well drained soil is on summits, shoulder slopes, and back slopes in the uplands. Areas are narrow and irregularly shaped and are 5 to 40 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is about 8 inches of yellowish brown silty clay loam mixed with a small amount of dark yellowish brown silt loam. It is dominantly subsoil material. The subsoil is about 25 inches thick. The upper part is strong brown, firm silty clay loam; the next part is strong brown, mottled, very firm silty clay; and the lower part is gray, mottled, very firm silty clay. The substratum is reddish brown, mottled shaly silty clay loam. Hard black shale bedrock is at a depth of about 39 inches. In places the depth to black shale is more than 40 inches.

Included with this soil in mapping, on summits, shoulder slopes, and back slopes at the higher elevations, are small areas of the moderately well drained Jennings soils, which have a fragipan. These soils make up 5 to 10 percent of the map unit.

Available water capacity is moderate in the Trappist soil, and permeability is slow. Surface runoff is rapid. Because of the severe erosion, organic matter content is low in the surface layer and natural fertility is reduced. The surface layer is strongly acid unless limed. It cannot be easily worked.

Most areas are used for hay and pasture. Some are used for cultivated crops.

This soil is poorly suited to corn, soybeans, and small grain. Erosion is the major hazard. Measures that help to control erosion and surface runoff are needed if cultivated crops are grown. Examples are a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue management help to control erosion and improve or maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay and is well suited to pasture. Growing grasses and legumes is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees. Seedling mortality and plant competition are the main management concerns. Selecting special planting stock and overstocking help to overcome seedling mortality. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the shrink-swell potential, the slope, and the depth to bedrock, this soil is moderately limited as a site for dwellings without basements. It is severely limited as a site for dwellings with basements because of the depth to bedrock. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The dwellings should be designed so that they conform to the natural slope of the land. The depth to bedrock also should be considered when the dwellings are designed. The soil is severely limited as a site for local roads and streets because of low strength. The base material can be strengthened or replaced with better suited material that can support vehicular traffic.

This soil is severely limited as a septic tank absorption field because of the slow permeability and the depth to bedrock. Installing the absorption field in better suited fill material helps to overcome the restricted permeability. The depth to bedrock can be increased by filling or mounding the site with suitable filtering material.

The land capability classification is IVe. The woodland ordination symbol is 4c.

TtD3—Trappist silty clay loam, 12 to 25 percent slopes, severely eroded. This strongly sloping, moderately deep, well drained soil is on back slopes in the uplands. Areas are narrow and irregularly shaped and are 5 to 80 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is about 3 inches of yellowish brown and strong brown silty clay loam mixed with a small amount of dark yellowish brown silt loam. It is dominantly subsoil material. The subsoil is about 18 inches thick. It is strong brown and firm. The upper part is silty clay loam, and the lower part is mottled silty clay. The substratum is brown, mottled shaly silty clay loam. Hard black shale bedrock is at a depth of about 39 inches. In some areas the depth to black shale is more than 40 inches. In other areas the depth to bedrock is less than 20 inches.

Included with this soil in mapping, on summits, shoulder slopes, and back slopes at the higher elevations, are small areas of the moderately well drained Jennings soils, which have a fragipan. These soils make up 5 to 10 percent of the map unit.

Available water capacity is low in the Trappist soil, and permeability is slow. Surface runoff is very rapid. Because of the severe erosion, organic matter content is low in the surface layer and natural fertility is reduced. The surface layer is strongly acid unless limed.

Most areas are used for woodland or for hay and pasture. Some are idle. A few small areas are used for cultivated crops.

This soil generally is unsuited to cultivated crops because of the slope and a severe hazard of erosion. Small grain is occasionally grown so that stands of grasses and legumes can be reestablished.

This soil is suited to grasses and legumes for pasture. It is poorly suited to hay, however, because of the slope and a severe hazard of erosion. Growing grasses and legumes for pasture is effective in controlling erosion. Overgrazing or trampling by livestock when the soil is wet, however, damages the sod, reduces plant density and forage yields, and causes surface compaction, poor tilth, and excessive surface runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees. The equipment limitation, the erosion hazard, and seedling mortality are the main management concerns. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on the steeper slopes. When the soil is wet, logging roads tend to be slippery and ruts form quickly. Because of the erosion hazard, the grade of logging roads, skid trails, and landings should be gentle and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. Seedlings survive and grow well if competing vegetation is controlled and livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because of the slope, this soil is severely limited as a site for dwellings without basements. It is severely limited as a site for dwellings with basements because of the slope and the depth to bedrock. The site can be graded so that the slope is modified. The dwellings should be designed so that they conform to the natural slope of the land. The depth to bedrock also should be considered when the dwellings are designed. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. The soil is severely limited as a site for local

roads and streets because of the slope and low strength. The base material can be strengthened with better suited material that can support vehicular traffic. Because of the slope, cutting and filling are needed and the roads should be built on the contour if possible.

This soil is severely limited as a septic tank absorption field because of the depth to bedrock, the slope, and the slow permeability. Installing the absorption field in better suited fill material helps to overcome the restricted permeability. The depth to bedrock can be increased by filling or mounding the site with suitable filtering material. Land shaping and installation of the distribution lines across the slope generally are needed before the absorption field can function properly.

The land capability classification is VIe. The woodland ordination symbol is 4c.

Ud—Udorthents, loamy. These nearly level to very steep, shallow to deep, somewhat poorly drained to well drained soils are in disturbed areas on upland, terraces, and bottom land. They are around highways and highway interchanges, shopping centers, sanitary landfills, and the Clifty Creek Power Plant. In some places, deep cuts have been made in the original land surface and the soil material is used to fill in lower lying areas and provide a smoother, more nearly level landform. In other places the soil material has been removed and used as fill for highway grades and exit ramps. Sand, gravel, and loamy soils have been spread over some areas. Areas are 3 to 200 acres in size. The dominant size is about 50 acres.

A typical area of fill has a mixture of surface soil, subsoil, and substratum material. The texture is silt loam, loam, silty clay loam, clay loam, and sandy loam. In some areas deep cuts have exposed clayey soil material, limestone fragments, and interbedded limestone and calcareous shale.

Included with these soils in mapping are small areas of short, steep slopes, escarpments, and areas where bedrock crops out. Also included, on the terraces along the Ohio River, are sandy soils that contain gravel. Highways, streets, buildings, and concrete and metal structures cover much of the surface in some areas.

Available water capacity is low or moderate in these soils, and permeability is moderate to slow. Organic matter content is low in the surface material, and reaction is very strongly acid to mildly alkaline.

Most areas support a permanent cover of grasses or low-growing shrubs. Many areas are surrounded by heavily traveled highways. Special management of these soils is needed. An intensified fertility program with special emphasis on the incorporation of organic residue or manure is needed if the soils are used for crops. Diversions, box inlet structures, grade stabilization structures, and grassed waterways help to control erosion in the gently sloping to very steep areas. Exposed areas should be revegetated as soon as possible after construction.

Onsite investigation is needed if these soils are to be used as building sites. The depth to gravel and bedrock should be considered. Because the soil material varies, engineering test data should be collected. The soil properties that affect the design of a structure vary within short distances. Removing as little vegetation as possible from building sites and establishing a protective plant cover as quickly as possible help to control erosion. The limitations that affect sanitary facilities vary. As a result, onsite investigation is needed. Permeability, clayey material, slope, content of coarse fragments, and depth to gravel and bedrock should be considered.

No land capability classification or woodland ordination symbol is assigned.

Wt—Wirt silt loam, occasionally flooded. This nearly level, deep, well drained soil is on bottom land. It is occasionally flooded for brief periods. Areas are narrow and extend for long distances along the streams. They are 5 to 180 acres in size. The dominant size is about 40 acres.

In a typical profile, the surface layer is dark brown silt loam about 8 inches thick. The subsoil is about 30 inches thick of dark brown and dark yellowish brown, friable silt loam and loam. The substratum to a depth of 60 inches is dark yellowish brown, friable sandy loam and cherty sandy loam. In some small areas the surface layer and subsoil contain more silt and less sand. In some areas free carbonates are throughout the subsoil.

Included with this soil in mapping, on the lower part of the adjacent back slopes, are small areas of the moderately deep Caneyville soils and small areas of the more clayey Grayford soils. Also included, on the adjacent valley trains, are small areas of the more clayey Negley soils, which formed in loess and glacial drift or outwash. Included soils make up 5 to 10 percent of the map unit.

Available water capacity is high in the Wirt soil, and permeability is moderate. Surface runoff is slow. Organic matter content is moderate in the surface layer. This layer is neutral to medium acid. It is friable and can be easily worked.

Most areas are used for cultivated crops. Some are used for hay and pasture.

This soil is well suited to corn and soybeans. It is not suited to small grain, however, because of the severe crop damage caused by floodwater. The main hazard is the occasional flooding. Crop residue management, cover crops, and green manure crops improve or maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Alfalfa is subject to severe damage during periods of flooding. Overgrazing or trampling by livestock when the soil is wet damages the sod, reduces plant density and forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, additions of lime and fertilizer, timely grazing,

and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled, especially during the first few years, and if livestock is excluded from the wooded areas. Unwanted trees and shrubs can be controlled or removed by adequate site preparation or by spraying, cutting, or girdling.

Because the occasional flooding is a severe hazard, this soil generally is unsuitable as a site for dwellings, local roads and streets, and septic tank absorption fields. Unless the soil is protected from flooding, alternative sites for these uses should be selected.

The land capability classification is IIw. The woodland ordination symbol is 1a.

Prime Farmland

Prime farmland is one of several kinds of important farmlands defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, must encourage and facilitate the use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cropland, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It is either used for food or fiber or is available for these uses. The soil qualities, growing season, and moisture supply are those needed for a well managed soil economically to produce a sustained high yield of crops. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland usually has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available from local offices of the Soil Conservation Service.

About 124,383 acres in Jefferson County, or nearly 53 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county, mainly in map units 2, 3, 4, and 6 on the general soil map, which are described under the heading "General Soil Map Units." Nearly all of the prime farmland is used for cultivated crops.

Some parts of the county have been losing some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in Jefferson County that are considered prime farmland are listed in table 6. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 5. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units."

Some soils that have a seasonal high water table qualify for prime farmland only in areas where this limitation has been overcome by a drainage system. The need for drainage is indicated in parentheses after the name of these soils in table 6. Onsite evaluation is needed to determine whether or not this limitation has been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

David Howell, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

A total of 82,677 acres in Jefferson County was used as cropland in 1978 *(8)*. Of this total, 57,798 acres was used for row crops, mainly corn and soybeans; 2,208 acres for wheat and oats; 1,450 acres for tobacco; 12,124 acres for permanent or rotation hay; and 9,097 acres for other kinds of crops. About 16,835 acres was used for permanent pasture.

The potential of the soils in Jefferson County for increased production of food is good. Food production could be increased considerably by extending the latest crop production technology to all of the cropland in the county. This soil survey can greatly facilitate the application of such technology.

The major management concerns affecting the areas used for crops and pasture in the county are described in the paragraphs that follow. These concerns are wetness, erosion, fertility, and tilth.

Wetness is the major problem on about 35 percent of the cropland, hayland, and pasture in the county. Most of the poorly drained and somewhat poorly drained soils, such as Avonburg, Cobbsfork, Holton, and Rahm, have been sufficiently drained for agricultural uses. In areas where they are adequately drained, they are among the more productive soils in the county. In areas where they are not adequately drained, artificial drainage may be needed to reduce the extent of crop damage that occurs during most years. These soils make up about 65,000 acres in the county.

The design of surface and subsurface drainage systems varies with the kind of soil. Shallow surface drains in combination with land leveling are needed in areas of Cobbsfork soils that are intensively row cropped. A subsurface drainage system is of some limited benefit on these soils. It may also be useful when installed beneath grassed waterways.

Soil erosion is the major problem on about 58 percent of the cropland, hayland, and pasture in the county. It is a hazard if the slope is more than 2 percent.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into a plow layer. Loss of the surface layer is especially damaging on soils having a clayey subsoil, such as Eden, Bonnell, Carmel, and Switzerland soils, and on soils having a layer in or below the subsoil that limits the depth of the root zone. The fragipan in Cincinnati soils, for example, cannot be penetrated by plant roots. The root zone consists of the soil material above the fragipan. As the topsoil is removed by erosion, the depth of the root zone is reduced. Second, soil erosion results in sedimentation of streams. Control of erosion minimizes the pollution of streams by sediment and improves water quality for municipal use, for recreation, and for fish and wildlife.

In many sloping fields, preparing a good seedbed and tilling are difficult on clayey spots where the original friable surface soil has been eroded away. Such spots are common in areas of eroded Carmel and Trappist soils.

Measures that control erosion provide a protective cover, reduce the runoff rate, and increase the infiltration rate. A cropping system that keeps vegetative cover on the surface for extended periods can minimize soil losses and help to maintain the productive capacity of the soils. On livestock farms, where forage crops are grown, including legumes and grasses in the cropping sequence helps to control erosion on sloping land, provides additional nitrogen, and improves the tilth of the soil for the following crop.

On sloping soils, cropping systems that provide substantial vegetative cover are needed to control erosion unless tillage is minimized. Minimizing tillage and leaving crop residue on the surface increase the infiltration rate and reduce the hazards of runoff and erosion. They are effective on most of the soils in the survey area but are not so successful on eroded soils and on the soils that have a clayey surface layer. No-till production of corn and soybeans, which is common on an increasing acreage, is effective in controlling erosion on sloping land and is suited to most of the soils in the survey area. It is less effective, however, on soils that have a clayey surface layer and on cold, wet soils that warm up slowly in the spring.

Diversions and cross-slope drainage ditches, which shorten the length of slopes, are effective in controlling sheet, rill, and gully erosion. They are most practical on deep soils that are highly susceptible to erosion. They reduce soil loss and the associated loss of fertilizer elements, help to prevent the crop damage and damage to watercourses caused by sedimentation, and help to eliminate the need for grassed waterways, which take productive land out of row crops. They also reduce the difficulty of contour farming, which reduces the amount of fuel used and the amount of pesticides entering watercourses. Soils that have bedrock within a depth of 40 inches and soils that have a heavy clayey subsoil are not so suitable for terraces and diversions as other soils.

Grassed waterways are needed in many areas of gently sloping and moderately sloping soils, such as Rossmoyne and Cincinnati. Some type of structure generally is needed to protect the outlet. In areas of many other soils, grassed waterways can drain large volumes of water at a nonerosive velocity. A subsurface drainage system is needed if waterways are established on Avonburg and Rossmoyne soils or in many areas of Cincinnati soils, which are seepy along drainageways.

Soil fertility is naturally low or moderate in most of the soils on uplands and terraces in the county, except for those that formed entirely in material weathered from limestone and calcareous shale. The soils on flood plains, such as Haymond, Huntington, and Wirt, are medium acid to neutral and are naturally higher in content of plant nutrients than most of the soils on uplands and terraces. The well drained soils on ridgetops and hillsides, such as Cincinnati, Carmel, and Switzerland, are subject to leaching. They generally are strongly acid or very strongly acid.

Most of the soils on uplands and terraces are naturally strongly acid or very strongly acid. Applications of ground limestone generally are needed on these soils to raise the pH level so that alfalfa and other crops that grow well on nearly neutral soils can attain optimum growth. Available phosphorus and potash levels are naturally low in most of these soils. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime needed.

Soil tilth affects the ease of tillage, the germination of seeds, seedling emergence, root penetration, and the infiltration of water into the soil. Soils with good tilth are granular and porous and have a significant amount of organic matter. Tilth is affected by methods of cultivation and the moisture condition at the time of cultivation.

Many of the soils used for crops in the survey area have a silt loam surface layer that is light or moderately dark in color and low in content of organic matter. Generally, the structure of these soils is moderate to weak, and a crust can form at the surface during periods of intense rainfall. The crust in some areas is hard when dry and impervious to water. Once a hard crust forms, the infiltration rate is reduced and the runoff rate is increased. Regular additions of crop residue, manure, and other organic material improve soil structure and help to prevent surface crusting.

Fall plowing is generally not a good practice on the soils in the county. After they are plowed in the fall, many of the soils are nearly as dense and hard at planting time as they were before they were tilled. Also, about 75 percent of the cropland consists of sloping soils that are subject to damaging erosion if they are

plowed in the fall, and many bottom land soils are subject to scouring because of flash flooding in winter and early spring.

Field crops suited to the soils and climate in the survey area include many that are not now commonly grown. Corn and soybeans are the main row crops. Tobacco is grown on a relatively small acreage but provides a relatively large income. Wheat and oats are the common close-growing crops. Rye could be grown, and grass seed could be produced from bromegrass, fescue, redtop, and bluegrass.

Specialty crops are of commercial importance in the county. Only a small acreage is used for tobacco, vegetables, and small fruits. Deep, well drained soils that warm up early in spring are especially well suited to these crops. These are the Crider Variant, Dearborn, Elkinsville, Haymond, Huntington, Negley, Ryker, and Wirt soils that have a slope of less than 6 percent. They make up about 21,000 acres in the county. On Dearborn, Haymond, Huntington, and Wirt soils, measures that help to control flooding are needed. Although specialty crops are grown on other soils in the county, they generally can be planted and harvested earlier on these deep, well drained soils.

If adequately drained, the poorly drained Cobbsfork and somewhat poorly drained Avonburg soils are suited to a limited number of vegetable crops planted a limited number of times. These soils make up about 60,000 acres in the county.

Most of the well drained soils in the county are suitable for orchards and nursery plants. Soils in low positions where frost is frequent and air drainage is poor, however, generally are poorly suited to early vegetables, small fruits, and orchards.

The latest information about growing specialty crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 7. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in table 7.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 7 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 8. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in table 7.

Woodland Management and Productivity

Table 9 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each suitable soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. It is based on the site index of the species listed first in the *common trees* column. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *r* indicates steep slopes; *x*, stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted rooting depth; *c*, clay in the upper part of the soil; *s*, sandy texture; and *f*, high content of coarse fragments in the soil profile. The letter *a* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: r, x, w, t, d, c, s, and f.

In table 9, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that few trees may be blown down by strong winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility

of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 10 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 10 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 11, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 11 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 14 and interpretations for dwellings without basements and for local roads and streets in table 13.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 12, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, sorghum, and sunflower.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, timothy, bromegrass, bluegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are goldenrod, beggarweed, wheatgrass, ragweed, pokeweed, sheep sorrel, dock, crabgrass, and dandelion.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, wild cherry, sweetgum, willow, black walnut, apple, hawthorn, dogwood, hickory, hazelnut, blackberry, and elderberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Washington hawthorn, autumn-olive, highbush cranberry, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, spikerush, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, dove, meadowlark, field sparrow, cottontail, red fox, and woodchuck.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and white-tailed deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, rails, kingfishers, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for

planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 13 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil

reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 14 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 14 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 14 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 14 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are

free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 15 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 15, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 16 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

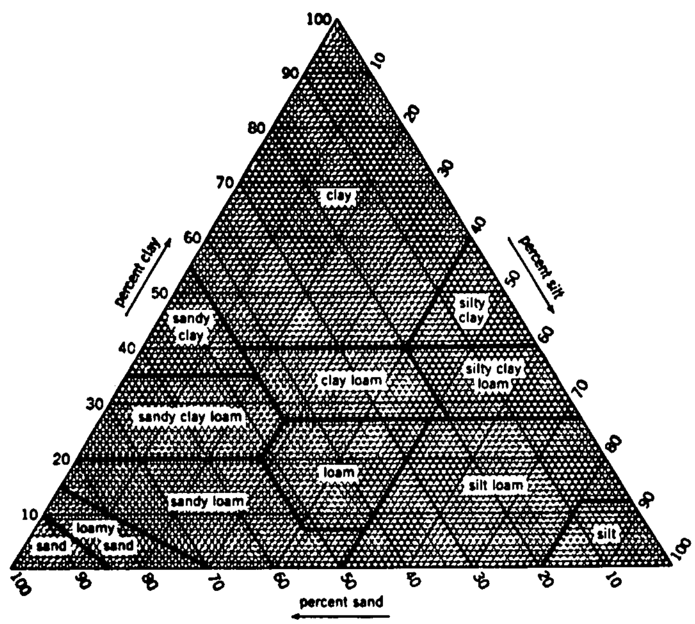


Figure 16.—Percentages of clay, silt, and sand in the basic USDA soil texture classes.

Engineering Index Properties

Table 17 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 16). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of

grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterburg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 18 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to absorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to

buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 18, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 19 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 19 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 19 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 19.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(7)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalf (*Ud*, meaning humid, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalfs*, the suborder of the Alfisols that have a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (6)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (7)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Avonburg Series

The Avonburg series consists of deep, somewhat poorly drained, very slowly permeable soils on glacial drift plains. These soils formed in a thin layer of loess and in the underlying glacial drift. Slopes range from 0 to 4 percent.

Avonburg soils generally are adjacent to Cobbsfork and Rossmoyne soils. Cobbsfork soils are grayer in the upper subsoil than the Avonburg soils and do not have a fragipan within a depth of 50 inches. They are near the center of tabular divides. Rossmoyne soils have fewer gray mottles in the upper subsoil than the Avonburg

soils. They are on summits, shoulder slopes, and the upper part of back slopes.

Typical pedon of Avonburg silt loam, 0 to 2 percent slopes, in a cultivated field; 600 feet west and 2,370 feet north of the southeast corner of sec. 28, T. 4 N., R. 10 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

Bt—10 to 19 inches; yellowish brown (10YR 5/6) silt loam; many medium distinct light brownish gray (10YR 6/2) and pale brown (10YR 6/3) mottles; weak medium subangular blocky structure; friable; few fine roots; thin patchy yellowish brown (10YR 5/6) clay films on faces of peds and in voids; slightly acid; clear wavy boundary.

Btg—19 to 30 inches; light brownish gray (10YR 6/2) silty clay loam; few fine distinct strong brown (7.5YR 5/8) and many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium angular and subangular blocky structure; friable; few fine roots; thin patchy yellowish brown (10YR 5/6) clay films on faces of peds; few fine very dark gray (10YR 3/1) iron and manganese oxide accumulations; very strongly acid; clear wavy boundary.

2Btxg—30 to 57 inches; light brownish gray (10YR 6/2) silt loam; many medium distinct strong brown (7.5YR 5/8) and few medium distinct brownish yellow (10YR 6/6) and yellowish brown (10YR 5/6) mottles; strong very coarse prismatic structure parting to moderate medium subangular blocky; very firm and brittle in more than 60 percent of the volume; few fine roots in channels; thin continuous grayish brown (10YR 5/2) and patchy brown (7.5YR 5/4) clay films on faces of prisms and in voids; discontinuous light gray (10YR 7/1) silt coatings on the tops and faces of prisms; few fine very dark gray (10YR 3/1) iron and manganese oxide accumulations; few pebbles; very strongly acid; gradual wavy boundary.

2Btg—57 to 80 inches; light brownish gray (10YR 6/2) silt loam; many medium distinct strong brown (7.5YR 5/8) and few medium distinct brownish yellow (10YR 6/6) and yellowish brown (10YR 5/6) mottles; weak medium angular and subangular blocky structure; friable; few fine roots in channels; thin discontinuous grayish brown (10YR 5/2) and patchy brown (7.5YR 5/4) clay films on faces of peds and in voids; few fine very dark gray (10YR 3/1) iron and manganese oxide accumulations; few pebbles; very strongly acid.

The thickness of the solum ranges from 60 to more than 80 inches. The thickness of loess ranges from 20 to 40 inches.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. It is strongly acid to neutral.

The Btg horizon has value of 5 or 6 and chroma of 2 to 6 and is distinctly mottled. It is silt loam or silty clay loam and is very strongly acid or strongly acid.

The 2Btxg horizon has value of 5 or 6 and chroma of 1 or 2 and is distinctly mottled. It is silt loam, silty clay loam, or clay loam and is very strongly acid or strongly acid. The 2Btg horizon has hue of 10YR, 2.5Y, or 7.5YR, value of 4 to 6, and chroma of 1 to 6 and is distinctly mottled. It is clay loam, loam, or silt loam. It is strongly acid or very strongly acid in the upper part and very strongly acid to slightly acid in the lower part.

Beasley Series

The Beasley series consists of deep, well drained, moderately slowly permeable soils on uplands. These soils formed in material weathered from interbedded soft limestone and calcareous shale and siltstone. Slopes range from 12 to 25 percent.

Beasley soils are similar to Carmel and Eden soils and generally are adjacent to Grayford and Switzerland soils. Carmel and Switzerland soils formed in loess and in the underlying material weathered from limestone and calcareous shale. Their solum is thicker than that of the Beasley soils. Switzerland soils are in the slightly higher positions on the landscape. Eden soils formed in material weathered from interbedded limestone and calcareous shale and have paralithic contact within a depth of 40 inches. Grayford soils formed in a thin layer of loess and in the underlying glacial drift and limestone bedrock residuum. They contain more sand and less clay in the solum than the Beasley soils. Also, they are in higher positions on the landscape.

Typical pedon of Beasley silt loam, in an area of Beasley-Rock outcrop complex, 12 to 25 percent slopes, severely eroded; 1,450 feet east and 1,500 feet south of the northwest corner of sec. 28, T. 4 N., R. 11 E.

Ap—0 to 3 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine subangular blocky structure; friable; many fine and few medium roots; neutral; abrupt smooth boundary.

Bt1—3 to 9 inches; yellowish brown (10YR 5/6) silty clay; moderate medium subangular blocky structure; very firm; common fine roots; thin discontinuous yellowish brown (10YR 5/4) clay films on faces of peds; few black (10YR 2/1) iron and manganese oxide accumulations; slightly acid; clear smooth boundary.

Bt2—9 to 15 inches; yellowish brown (10YR 5/6) clay; moderate medium subangular blocky structure; very firm; few medium roots; thin continuous light yellowish brown (2.5Y 6/4) clay films on faces of peds; neutral; clear wavy boundary.

BC—15 to 22 inches; light olive brown (2.5Y 5/6) silty clay; many medium and coarse distinct light gray (10YR 7/1) and pale yellow (2.5Y 7/4) mottles; weak medium subangular blocky structure; common fine roots; thin patchy light olive brown (2.5Y 5/4) clay films on faces of peds; slight effervescence; mildly alkaline; gradual wavy boundary.

C—22 to 44 inches; yellow (2.5Y 7/6) silt loam; many medium and coarse distinct light gray (2.5Y 7/2) mottles; massive; firm; few fine roots; about 10 percent shale and siltstone fragments less than three-fourths of an inch in size; strong effervescence; moderately alkaline; gradual wavy boundary.

Cr—44 to 60 inches; light greenish gray (5GY 7/1) siltstone and clay shale; many medium distinct yellow (2.5Y 7/8) mottles; massive; very firm; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches. The depth to soft bedrock ranges from 40 to 60 inches. The depth to hard limestone is more than 5 feet.

The Ap horizon has chroma of 3 or 4. It is silt loam or silty clay loam and is strongly acid to neutral.

The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is strongly acid to neutral. The BC horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 4 to 8 and is distinctly mottled in most pedons. It is medium acid to moderately alkaline.

The C horizon has value of 6 or 7 and chroma of 4 to 8. It is neutral to moderately alkaline. It is loam, silt loam, silty clay loam, clay loam, silty clay, or clay. The content of coarse soft limestone, siltstone, and shale fragments ranges from 0 to 35 percent in the upper part of this horizon.

Bonnell Series

The Bonnell series consists of deep, well drained, slowly permeable soils on glacial drift plains. These soils formed in loess and in the underlying glacial drift. Slopes range from 6 to 45 percent.

The Bonnell soils are similar to Carmel and Hickory soils and generally are adjacent to Cincinnati and Crider Variant soils. Carmel soils formed in loess and in the underlying limestone and shale residuum. Their solum is thinner than that of the Bonnell soils. Hickory soils have less clay and more sand in the subsoil than the Bonnell soils. Cincinnati soils have more silt and less clay than the Bonnell soils and have a fragipan. Crider Variant soils formed in loess and in the underlying limestone residuum. Their solum is thinner than that of the Bonnell soils. Cincinnati and Crider Variant soils are slightly higher on the landscape than the Bonnell soils or are in similar positions.

Typical pedon of Bonnell silt loam, 12 to 18 percent slopes, eroded, in a cultivated field; 1,000 feet west and 2,600 feet north of the southeast corner of sec. 8, T. 5 N., R. 12 E.

Ap—0 to 7 inches; yellowish brown (10YR 5/4) silt loam, very pale brown (10YR 7/3) dry; mixed with a small amount of strong brown (7.5YR 5/6) clay loam; weak medium subangular blocky structure; friable; many fine roots; strongly acid; abrupt smooth boundary.

2Bt1—7 to 12 inches; strong brown (7.5YR 5/6) clay loam; moderate medium subangular blocky structure; firm; common fine roots; thin discontinuous yellowish brown (10YR 5/4) clay films on faces of peds; strongly acid; gradual wavy boundary.

2Bt2—12 to 16 inches; strong brown (7.5YR 5/6) clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous brown (7.5YR 5/4) clay films on faces of peds; strongly acid; gradual wavy boundary.

2Bt3—16 to 27 inches; strong brown (7.5YR 5/6) clay loam; moderate medium angular and subangular blocky structure; firm; thin discontinuous brown (7.5YR 5/4) clay films on faces of peds; few pebbles; medium acid; gradual wavy boundary.

2Bt4—27 to 36 inches; strong brown (7.5YR 5/6) clay loam; moderate medium angular and subangular blocky structure; very firm; thin continuous brown (7.5YR 5/4) clay films on faces of peds; few pebbles; medium acid; gradual wavy boundary.

2Bt5—36 to 43 inches; yellowish brown (10YR 5/6) clay loam; moderate medium angular and subangular blocky structure; very firm; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; common fine very dark gray (N 3/0) iron and manganese oxide accumulations; few pebbles; medium acid; gradual wavy boundary.

2BC—43 to 55 inches; yellowish brown (10YR 5/6) clay loam; weak medium angular and subangular blocky structure; very firm; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; common fine very dark gray (N 3/0) iron and manganese oxide accumulations; few pebbles; slightly acid; gradual wavy boundary.

2C—55 to 60 inches; yellowish brown (10YR 5/6) loam; many coarse distinct pale brown (10YR 6/3) mottles; massive; firm; common fine very dark gray (N 3/0) iron and manganese oxide accumulations; few pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 50 to 80 inches. The thickness of the loess ranges from 3 to 18 inches.

The A horizon, if it occurs, has value of 2 to 4 and chroma of 1 or 2. The Ap horizon has value of 4 or 5 and chroma of 2 to 4. It is loam or silt loam and ranges

from very strongly acid to neutral. Some pedons have a BE horizon, which is silt loam or silty clay loam.

The 2Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is clay loam, silty clay, or clay. It is very strongly acid to medium acid in the upper part and medium acid to moderately alkaline in the lower part.

The 2C horizon has value of 4 or 5 and chroma of 4 to 6. It is loam or clay loam and is medium acid to moderately alkaline.

Caneyville Series

The Caneyville series consists of moderately deep, well drained, moderately slowly permeable soils on uplands. These soils formed in limestone bedrock residuum. Slopes range from 25 to 60 percent.

Caneyville soils are similar to Eden soils and generally are adjacent to Grayford and Ryker soils. Eden soils formed in material weathered from interbedded limestone and gray, calcareous shale. Their solum is yellower than that of the Caneyville soils. Grayford and Ryker soils are on summits, shoulder slopes, and back slopes. They formed in loess, glacial drift, and limestone residuum. Their solum is thicker than that of the Caneyville soils.

Typical pedon of Caneyville silt loam, in a wooded area of Eden-Caneyville complex, 25 to 60 percent slopes; 1,400 feet west and 2,700 feet south of the northeast corner of sec. 13, T. 3 N., R. 9 E.

A—0 to 5 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; many fine and medium roots; about 3 percent coarse fragments; neutral; abrupt smooth boundary.

Bt1—5 to 12 inches; brown (7.5YR 5/4) silty clay loam; weak medium subangular blocky structure; firm; common fine and medium roots; thin patchy dark brown (7.5YR 4/4) clay films on faces of peds; about 5 percent coarse fragments; neutral; clear smooth boundary.

Bt2—12 to 20 inches; yellowish red (5YR 5/6) silty clay; moderate medium subangular blocky structure; very firm; few medium roots; thin discontinuous reddish brown (5YR 4/4) clay films on faces of peds; about 10 percent coarse fragments; neutral; gradual wavy boundary.

Bt3—20 to 28 inches; yellowish red (5YR 4/6) silty clay; moderate medium subangular blocky structure; very firm; few medium roots; thin discontinuous reddish brown (5YR 4/4) clay films on faces of peds; about 10 percent coarse fragments; neutral; gradual wavy boundary.

BC—28 to 34 inches; yellowish red (5YR 4/6) silty clay; moderate medium subangular blocky structure; very firm; few medium roots; thin discontinuous reddish brown (5YR 4/4) clay films on faces of peds; about 10 percent coarse fragments; neutral; abrupt irregular boundary.

R—34 inches; hard limestone bedrock.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The thickness of loess ranges from 0 to 15 inches.

The A horizon has value of 3 to 5 and chroma of 2 to 4. It is silt loam or silty clay loam and is slightly acid to mildly alkaline.

The Bt horizon has hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silty clay loam, silty clay, or clay and is medium acid to neutral. The content of coarse limestone and chert fragments ranges from 0 to 15 percent.

The BC horizon has hue of 5YR or 7.5YR and value and chroma of 3 to 6. It is silty clay or clay and is medium acid to neutral. The content of coarse limestone and chert fragments in this horizon ranges from 0 to 15 percent.

Carmel Series

The Carmel series consists of deep, well drained, very slowly permeable soils on uplands. These soils formed in a thin layer of loess and in the underlying material weathered from interbedded limestone and soft, calcareous shale. The shale predominates. Slopes range from 6 to 12 percent.

Carmel soils are similar to Beasley and Eden soils and generally are adjacent to Switzerland soils. Beasley soils formed in material weathered from interbedded soft limestone, calcareous shale, and siltstone. Their solum is thinner than that of the Carmel soils. Eden soils are on back slopes below the Carmel soils. They are moderately deep over interbedded limestone and shale. Switzerland soils formed in 20 to 36 inches of loess and in the underlying residuum. Their solum is thicker than that of the Carmel soils.

Typical pedon of Carmel silt loam, 6 to 12 percent slopes, eroded, in a wooded area; 325 feet west and 2,600 feet north of the southeast corner of sec. 19, T. 4 N., R. 12 E.

Ap—0 to 6 inches; dark yellowish brown (10YR 4/4) silt loam mixed with a small amount of strong brown (7.5YR 5/6) silty clay loam; very pale brown (10YR 7/4) dry; moderate thick platy structure; friable; common fine roots; medium acid; abrupt smooth boundary.

Bt1—6 to 12 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; few medium roots; thin patchy strong brown (7.5YR 5/6) clay films on faces of peds; strongly acid; clear smooth boundary.

Bt2—12 to 17 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky

structure; firm; few fine roots; thin discontinuous strong brown (7.5YR 4/6) clay films on faces of peds; strongly acid; gradual wavy boundary.

2Bt3—17 to 30 inches; strong brown (7.5YR 5/6) silty clay; common fine prominent light brownish gray (2.5YR 6/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous brown (7.5YR 5/4) clay films on faces of peds; few strong brown (7.5YR 5/6) slickensides; strongly acid; gradual wavy boundary.

2Bt4—30 to 36 inches; strong brown (7.5YR 5/6) clay; common fine prominent light yellowish brown (2.5Y 6/4) mottles; weak medium and coarse subangular blocky structure; very firm; few fine roots; thin patchy yellowish brown (10YR 5/6) clay films on faces of peds; common yellowish brown (10YR 5/6) slickensides; common fine very dark grayish brown (10YR 3/2) iron and manganese oxide accumulations; strongly acid; gradual wavy boundary.

2BC—36 to 43 inches; yellowish brown (10YR 5/6) clay; common medium distinct light olive brown (2.5Y 5/4) mottles; weak medium and coarse subangular blocky structure; very firm; thin patchy light olive brown (2.5Y 5/6) clay films on faces of peds; common light olive brown (2.5Y 5/6) slickensides; common fine dark brown (10YR 3/3) iron and manganese oxide accumulations; slightly acid; clear wavy boundary.

2C—43 to 50 inches; yellowish brown (10YR 5/6) flaggy clay; common medium distinct brown (10YR 4/3) and few medium distinct yellow (10YR 7/6) mottles; massive; firm; strong effervescence; moderately alkaline; abrupt irregular boundary.

2Cr—50 to 60 inches; interbedded limestone and calcareous clay shale.

The thickness of the solum ranges from 30 to 50 inches. The depth to limestone and calcareous shale ranges from 40 to 60 inches. The thickness of the loess ranges from 6 to 18 inches.

The Ap horizon has value of 4 or 5 and chroma of 3 or 4. It is silt loam or silty clay loam and is strongly acid to neutral.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam and is strongly acid to medium acid. The 2Bt horizon has hue of 10YR, 7.5YR, or 2.5Y; value of 4 or 5; and chroma of 4 to 6. It is very strongly acid or strongly acid.

The 2C horizon has colors similar to those of the 2Bt horizon. It is slightly acid to moderately alkaline. It is clay, silty clay, or the channery or flaggy analogs of these textures. In the channery or flaggy analogs, the content of coarse fragments ranges from 15 to 70 percent.

Cincinnati Series

The Cincinnati series consists of deep, well drained, slowly permeable soils on glacial drift plains. These soils formed in loess and in the underlying glacial drift. Slopes range from 2 to 12 percent.

Cincinnati soils are similar to Nicholson, Jennings, and Rossmoyne soils and generally are adjacent to Bonnell, Hickory, Holton, and Ryker soils. Nicholson soils formed in a thin layer of loess and in the underlying material weathered from interbedded limestone and calcareous shale. Their solum is thinner than that of the Cincinnati soils. Jennings soils overlie black shale bedrock. The lower part of their solum formed in material weathered from this bedrock and has more clay than that of the Cincinnati soils. Rossmoyne soils have gray mottles in the upper part of the subsoil. Bonnell, Hickory, and Ryker soils do not have a fragipan. They are on the lower slopes. Holton soils formed in loamy alluvium on flood plains. They have gray mottles in the upper part of the subsoil.

Typical pedon of Cincinnati silt loam, 2 to 6 percent slopes, eroded, in a hayfield; 700 feet east and 800 feet north of the southwest corner of sec. 1, T. 5 N., R. 10 E.

Ap—0 to 6 inches; dark brown (10YR 4/3) silt loam, very pale brown (10YR 7/4) dry; mixed with a small amount of yellowish brown (10YR 5/4) silt loam; moderate fine granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

BE—6 to 11 inches; yellowish brown (10YR 5/4) silt loam; few medium distinct dark brown (10YR 4/3) mottles; weak medium subangular blocky structure; friable; few fine roots; medium acid; clear smooth boundary.

Bt1—11 to 16 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; few fine roots; thin patchy yellowish brown (10YR 5/4) clay films on faces of peds; strongly acid; clear wavy boundary.

Bt2—16 to 21 inches; yellowish brown (10YR 5/6) silt loam; few fine distinct very pale brown (10YR 7/4) mottles; moderate medium subangular blocky structure; friable; few fine roots; thin discontinuous dark yellowish brown (10YR 4/4) clay films and patchy very pale brown (10YR 7/4) silt coatings on faces of peds; very strongly acid; gradual wavy boundary.

2Bt3—21 to 33 inches; yellowish brown (10YR 5/6) clay loam; few fine distinct light brownish gray (10YR 6/2) mottles; moderate medium prismatic structure parting to moderate medium angular and subangular blocky; firm; few fine roots; thin continuous yellowish brown (10YR 5/4) and thin discontinuous grayish brown (10YR 5/2) clay films on faces of peds; discontinuous pale brown (10YR 6/3) silt coatings on vertical faces of prisms; few pebbles less than

three-quarters of an inch in size; very strongly acid; clear wavy boundary.

2Btx1—33 to 46 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate very coarse prismatic structure parting to moderate medium subangular blocky; very firm and brittle in more than 60 percent of the volume; thin patchy light brownish gray (10YR 6/2) and yellowish brown (10YR 5/4) clay films on faces of all peds; common very pale brown (10YR 7/3) silt coatings on faces of prisms; few pebbles less than three-quarters of an inch in size and many larger than three-quarters of an inch; very strongly acid; clear wavy boundary.

2Btx2—46 to 56 inches; yellowish brown (10YR 5/6) clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; moderate very coarse prismatic structure parting to weak medium subangular blocky; very firm; thin discontinuous gray (10YR 6/1) clay films on faces of all peds; thin patchy dark grayish brown (10YR 4/2) clay films on faces of secondary peds; common very dark gray (N 3/0) iron and manganese oxide accumulations; few pebbles less than three-quarters of an inch in size and common chert fragments larger than three-quarters of an inch; very strongly acid; clear wavy boundary.

2Bt4—56 to 80 inches; strong brown (7.5YR 5/6) silty clay loam; common medium distinct yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; thin discontinuous grayish brown (10YR 5/2) clay films on faces of secondary peds; common very dark gray (N 3/0) iron and manganese oxide accumulations; few pebbles less than three-quarters of an inch in size and common chert fragments larger than three-quarters of an inch; very strongly acid.

The thickness of the solum and the depth to carbonates range from 48 to 100 inches. The thickness of the loess ranges from 18 to 40 inches.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. It is very strongly acid or strongly acid unless it is limed.

The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam, silty clay loam, or loam and is very strongly acid or strongly acid.

The 2Btx horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is loam, silty clay loam, or clay loam and is very strongly acid or strongly acid. The 2Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is very strongly acid to medium acid. It is loam, silty clay loam, or clay loam. The content of coarse fragments in this horizon ranges from 5 to 15 percent.

Cobbsfork Series

The Cobbsfork series consists of deep, poorly drained, very slowly permeable soils on glacial drift plains. These soils formed in loess and in the underlying glacial drift. Slopes range from 0 to 2 percent.

Cobbsfork soils generally are adjacent to Avonburg soils. The adjacent soils are browner in the upper part of the subsoil than the Cobbsfork soils and have a fragipan within a depth of 50 inches. They are on narrow tabular divides or are near the edge of these divides.

Typical pedon of Cobbsfork silt loam, in a cultivated field; 150 feet west and 1,300 feet north of the southeast corner of sec. 2, T. 5 N., R. 10 E.

Ap—0 to 6 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; common fine distinct gray (10YR 6/1) and many fine distinct yellowish brown (10YR 5/6) mottles; weak fine granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

A—6 to 12 inches; grayish brown (10YR 5/2) silt loam; common fine distinct gray (10YR 6/1) and few fine distinct yellowish brown (10YR 5/6) mottles; weak very coarse platy structure; friable; few fine roots; slightly acid; abrupt smooth boundary.

BEg—12 to 18 inches; light gray (10YR 7/1) silt loam; common medium distinct strong brown (7.5YR 5/8) mottles; moderate coarse subangular blocky structure; friable; few fine roots; medium acid; gradual wavy boundary.

Btg—18 to 27 inches; light brownish gray (10YR 6/2) silt loam; common fine distinct strong brown (7.5YR 5/8) and brownish yellow (10YR 6/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; thin discontinuous grayish brown (10YR 5/2) clay films on vertical faces of prisms; continuous gray (10YR 6/1) silt coatings on faces of vertical and horizontal peds; strongly acid; gradual wavy boundary.

Btxg1—27 to 38 inches; light brownish gray (10YR 6/2) silt loam; common fine distinct strong brown (7.5YR 5/8) and brownish yellow (10YR 6/6) mottles; moderate very coarse prismatic structure parting to moderate medium subangular blocky; firm and brittle in 50 to 60 percent of the volume; few fine roots on walls of prisms; thin discontinuous gray (10YR 6/1) clay films on vertical faces of prisms; continuous light gray (10YR 7/1) silt coatings, one-half inch to three-quarters of an inch thick, on faces of vertical and horizontal peds; krotovinas; strongly acid; gradual wavy boundary.

2Btxg2—38 to 50 inches; light brownish gray (10YR 6/2) silt loam; common fine distinct yellowish brown (10YR 5/4) and strong brown (7.5YR 5/6) mottles; moderate very coarse prismatic structure parting to

moderate medium angular blocky; firm and brittle in 50 to 60 percent of the volume; few fine roots on walls of prisms; thick discontinuous gray (10YR 6/1) clay films on vertical faces of prisms; continuous light gray (10YR 7/1) silt coatings, one-half inch to three-quarters of an inch thick, on faces of vertical and horizontal peds; krotovinas; common fine very dark gray (10YR 3/1) iron and manganese oxide accumulations; few pebbles; medium acid; gradual wavy boundary.

2Btx—50 to 77 inches; yellowish brown (10YR 5/4) silt loam; few fine faint light yellowish brown (10YR 6/4) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm and brittle; thin patchy gray (10YR 6/1) clay films and many gray (10YR 6/1) silt coatings in channels; common medium black (10YR 2/1) iron and manganese oxide accumulations; few pebbles; slightly acid; gradual wavy boundary.

2BC—77 to 80 inches; strong brown (7.5YR 5/8) clay loam; massive; firm; common medium very dark gray (10YR 3/1) iron and manganese oxide accumulations; few pebbles; neutral.

The thickness of the solum ranges from 80 to 108 inches. The thickness of the loess ranges from 36 to 48 inches. The depth to carbonates ranges from 96 to 144 inches. The depth to the brittle layer ranges from 36 to 48 inches.

The Ap and A horizons have value of 4 or 5 and chroma of 1 to 3. They are strongly acid to neutral.

The BEg horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 or 2. The Btg horizon has value of 5 or 6 and chroma of 1 or 2 and has mottles with hue of 10YR or 7.5YR and value and chroma of 4 to 8. It is silt loam or silty clay loam and is very strongly acid or strongly acid. The Btxg horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. It has mottles with hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 to 8. It is loam, silt loam, or silty clay loam and is very strongly acid or strongly acid.

The 2Btx horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 to 6. It has mottles with hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 to 8. It is loam, silt loam, or silty clay loam and is strongly acid or medium acid. The 2BC horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 1 to 6. It is medium acid to neutral.

Crider Variant

The Crider Variant consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess and in the underlying limestone bedrock residuum. Slopes range from 2 to 6 percent.

Crider Variant soils are similar to Grayford and Ryker soils and generally are adjacent to Bonnell, Deputy, and Jennings soils. Bonnell, Grayford, and Ryker soils have glacial drift in the solum. They are on summits, shoulder slopes, and back slopes. Deputy and Jennings soils formed in loess and in the underlying shale residuum and are yellower in the lower part of the solum than the Crider Variant soils. They are on summits, shoulder slopes, and back slopes in the western part of the county.

Typical pedon of Crider Variant silt loam, 2 to 6 percent slopes, eroded, in a pasture; 250 feet north and 1,250 feet west of the southeast corner of sec. 25, T. 5 N., R. 10 E.

Ap—0 to 7 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; mixed with a small amount of yellowish brown (10YR 5/4) silt loam; moderate medium granular structure; friable; many fine roots; medium acid; abrupt smooth boundary.

BA—7 to 13 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; common fine roots; medium acid; clear smooth boundary.

Bt1—13 to 39 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; common fine roots; thin discontinuous dark yellowish brown (10YR 4/6) clay films on faces of peds; strongly acid; gradual smooth boundary.

2Bt2—39 to 53 inches; yellowish red (5YR 5/6) clay; common medium prominent light yellowish brown (10YR 6/4) mottles; moderate medium and coarse subangular blocky structure; very firm; thin discontinuous yellowish red (5YR 4/6) and thin continuous pale brown (10YR 6/3) clay films on faces of peds; common medium black (10YR 2/1) iron and manganese oxide accumulations; medium acid; clear wavy boundary.

2BC—53 to 58 inches; yellowish red (5YR 5/5) clay; many medium prominent brownish yellow (10YR 6/6) mottles; moderate medium and coarse subangular blocky structure; very firm; thin continuous strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) clay films on faces of peds; many medium black (10YR 2/1) iron and manganese oxide accumulations; neutral; abrupt wavy boundary.

R—58 inches; hard limestone bedrock.

The thickness of the solum ranges from 40 to 60 inches and is the same as the depth to bedrock. The thickness of the loess ranges from 24 to 42 inches.

The Ap horizon has value of 4 or 5 and chroma of 3 or 4. It is strongly acid or medium acid unless limed.

The Bt horizon has hue of 10YR to 5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. It is very strongly acid to medium acid.

The 2Bt horizon has value of 4 or 5 and chroma of 4 to 6. It is silty clay, clay, or silty clay loam. It is very

strongly acid to medium acid. Some pedons have a thin 2BC horizon. This horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 6. It is silty clay or clay. It is slightly acid or neutral.

Dearborn Series

The Dearborn series consists of deep, well drained soils on flood plains. These soils are moderately permeable in the subsoil. They formed in local alluvium that was derived from limestone and shale. Slopes range from 0 to 2 percent.

These soils have a thicker solum, contain less clay in the subsoil, and in most horizons have a higher content of coarse fragments than is defined for the Dearborn series. These differences, however, do not alter the usefulness or behavior of the soils.

Dearborn soils are similar to Huntington soils and generally are adjacent to Eden, Pate, and Wirt soils. Huntington and Wirt soils have a lower content of coarse fragments throughout than the Dearborn soils. They are in the slightly higher positions on the landscape. Eden and Pate soils formed in material weathered from interbedded limestone and shale. Eden soils are on back slopes, and Pate soils are on foot slopes.

Typical pedon of Dearborn channery silt loam, frequently flooded, in an idle field; 650 feet south and 1,300 feet west of the northeast corner of sec. 8, T. 4 N., R. 11 E.

A—0 to 11 inches; dark brown (10YR 3/3) channery silt loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; many fine roots; about 30 percent coarse fragments, mostly channers; strong effervescence; moderately alkaline; gradual smooth boundary.

Bw1—11 to 16 inches; dark brown (10YR 4/3) extremely channery coarse loamy sand; single grain; loose; many fine roots; about 70 percent coarse fragments; strong effervescence; moderately alkaline; gradual wavy boundary.

Bw2—16 to 28 inches; dark brown (10YR 4/3) channery loam; weak fine subangular blocky structure; friable; common fine roots; about 20 percent coarse fragments; strong effervescence; moderately alkaline; abrupt wavy boundary.

C1—28 to 46 inches; yellowish brown (10YR 5/4) extremely channery coarse sandy loam that has thin strata of clay loam; single grain; loose; few fine roots; about 75 percent coarse fragments; strong effervescence; moderately alkaline; abrupt smooth boundary.

C2—46 to 60 inches; yellowish brown (10YR 5/4) extremely flaggy loamy sand; single grain; loose; about 75 percent coarse fragments, mostly flagstones; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 10 to 30 inches. The depth to channery or flaggy alluvium ranges from 10 to 30 inches.

The A horizon has hue of 10YR or 7.5YR, value of 3, and chroma of 2 or 3. It is silt loam or channery silt loam and is mildly alkaline or moderately alkaline.

The Bw horizon has hue of 10YR or 7.5YR and chroma of 2 to 4. It is loam, silt loam, silty clay loam, clay loam, sandy loam, loamy sand, loamy coarse sand, or the channery analogs of these textures. It is mildly alkaline or moderately alkaline.

The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loam, sandy loam, loamy sand, coarse sandy loam, loamy coarse sand, or the channery, flaggy, very channery, or very flaggy analogs of these textures.

Deputy Series

The Deputy series consists of deep, moderately well drained soils on uplands. These soils formed in a thin layer of loess and in the underlying shale bedrock residuum. Permeability is moderate in the upper part of the solum and moderately slow in the lower part. Slopes range from 2 to 12 percent.

Deputy soils are similar to Trappist soils and generally are adjacent to Crider Variant and Jennings soils. Trappist soils formed in 10 to 20 inches of loess and in the underlying residuum. They are less than 40 inches deep over black shale bedrock. Crider Variant soils formed in loess and limestone residuum and are redder in the lower part of the solum than the Deputy soils. They are on summits and shoulder slopes. Jennings soils formed in a thin layer of loess and in the underlying drift and shale residuum. They have a fragipan in the subsoil. They are in the slightly higher positions on the landscape.

Typical pedon of Deputy silt loam, 2 to 6 percent slopes, eroded, in a pasture; 1,200 feet west and 2,300 feet south of the northeast corner of sec. 17, T. 4 N., R. 8 E.

Ap—0 to 8 inches; mixed dark brown (10YR 4/3) and yellowish brown (10YR 5/4) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; common fine roots; slightly acid; abrupt wavy boundary.

Bt1—8 to 15 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common fine roots; thin patchy strong brown (7.5YR 5/6) clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt2—15 to 20 inches; yellowish brown (10YR 5/6) silt loam; common fine distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; common fine roots; thin

patchy brown (7.5YR 5/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt3—20 to 27 inches; yellowish brown (10YR 5/6) silty clay loam; many medium distinct light brownish gray (10YR 6/2) and few fine distinct dark brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous grayish brown (10YR 5/2) clay films on faces of peds; few very dark gray (10YR 3/1) iron and manganese oxide stains; very strongly acid; clear wavy boundary.

2Bt4—27 to 42 inches; yellowish brown (10YR 5/6) silty clay; common medium distinct gray (10YR 6/1) and few fine distinct dark brown (7.5YR 4/4) mottles; moderate medium angular blocky structure; very firm; few fine roots; thin discontinuous gray (10YR 5/1) clay films on faces of peds; few very dark gray (10YR 3/1) iron and manganese oxide stains; very strongly acid; clear wavy boundary.

2Bg—42 to 53 inches; light gray (10YR 7/1) silty clay; many medium distinct yellowish brown (10YR 5/6) mottles; weak coarse angular blocky structure; very firm; about 3 percent shale fragments 2 millimeters to 3/4 inch in size and 3 percent 3/4 inch to 3 inches in size; very strongly acid; gradual wavy boundary.

2Cr—53 to 77 inches; light gray (2.5Y 7/1) and light olive brown (2.5Y 5/6) silty clay shale; common medium distinct yellowish brown (10YR 5/6), strong brown (7.5YR 5/8), and very dark gray (2.5Y 3/1) mottles; breaks to coarse plates; very strongly acid; abrupt wavy boundary.

2R—77 inches; black shale bedrock.

The thickness of the solum and the depth to shale bedrock range from 40 to 60 inches. The thickness of loess ranges from 20 to 30 inches.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. It is silt loam or silty clay loam and is extremely acid to strongly acid unless limed.

The Bt horizon has hue of 10YR, 7.5YR, or 5YR; value of 4 or 5; and chroma of 4 to 8. It is very strongly acid or strongly acid. The 2Bt horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. It is silty clay loam, silty clay, or clay and is extremely acid or very strongly acid.

The 2Cr horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 to 6.

Eden Series

The Eden series consists of moderately deep, well drained, slowly permeable soils on uplands. These soils formed in material weathered from interbedded limestone and soft, calcareous shale. The shale predominates. Slopes range from 12 to 50 percent.

Eden soils are similar to Beasley, Caneyville, and Carmel soils and generally are adjacent to Dearborn and Switzerland soils. Beasley soils formed in material weathered from interbedded soft limestone and calcareous shale and siltstone and are deep. Caneyville soils formed in limestone residuum and are redder in the solum than the Eden soils. Carmel and Switzerland soils formed in a thin layer of loess and in material weathered from the underlying interbedded limestone and calcareous shale. They have a solum that is thicker than that of the Eden soils. Also, they are higher on the landscape. Dearborn soils formed in local alluvium on flood plains. They have more sand and less clay in the solum than the Eden soils.

Typical pedon of Eden flaggy silty clay loam, 25 to 50 percent slopes, in a forest of hardwoods; 700 feet east and 1,500 feet south of the northwest corner of sec. 31, T. 5 N., R. 11 E.

A—0 to 6 inches; dark brown (10YR 4/3) flaggy silty clay loam, light brownish gray (10YR 6/2) dry; weak medium granular and subangular blocky structure; friable; common fine roots; about 5 percent channers and 17 percent flagstones; neutral; clear smooth boundary.

Bt1—6 to 11 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; common fine and few coarse roots; thin patchy dark brown (10YR 4/3) clay films on faces of peds; discontinuous dark brown (10YR 4/3) organic coatings on faces of peds; about 5 percent channers and 5 percent flagstones; neutral; clear wavy boundary.

Bt2—11 to 20 inches; light olive brown (2.5Y 5/4) silty clay; strong medium subangular blocky structure; very firm; common fine roots; thin continuous light yellowish brown (2.5Y 6/4) clay films on faces of peds; about 5 percent channers and 10 percent flagstones; slight effervescence; mildly alkaline; clear wavy boundary.

Bt3—20 to 39 inches; light olive brown (2.5Y 5/4) flaggy silty clay; weak medium and coarse subangular blocky structure; very firm; few medium roots; thin discontinuous light yellowish brown (2.5Y 6/4) clay films on faces of peds; about 10 percent channers and 20 percent flagstones; strong effervescence; moderately alkaline; clear irregular boundary.

Cr—39 to 60 inches; slightly weathered calcareous shale interbedded with strata of fractured limestone.

The thickness of the solum ranges from 20 to 40 inches. It is about the same as the depth to interbedded limestone and calcareous shale.

The A horizon has value of 3 or 4 and chroma of 2 or 3. If it has value of 3, it is less than 7 inches thick. It is silty clay loam or flaggy silty clay loam. It is neutral or mildly alkaline.

The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 6. The Bt1 horizon is neutral or mildly alkaline. The Bt2 and Bt3 horizons are silty clay,

clay, or the flaggy analogs of these textures. They are neutral to moderately alkaline.

Elkinsville Series

The Elkinsville series consists of deep, well drained, moderately permeable soils on loess-covered terraces. These soils formed in loess and in the underlying stratified silty or loamy material. Slopes range from 0 to 8 percent.

Elkinsville soils are similar to the Negley soils and generally are adjacent to Huntington and Pekin soils. Negley soils have redder hue in the lower part of the solum than the Elkinsville soils. Huntington soils formed in silty recent alluvium on flood plains. Their surface layer is darker than that of the Elkinsville soils. Pekin soils have a fragipan and have gray mottles in the upper part of the subsoil. Their position on the landscape is similar to that of the Elkinsville soils.

Typical pedon of Elkinsville silt loam, 2 to 8 percent slopes, rarely flooded, in a cultivated field; 100 feet west and 1,850 feet south of the northeast corner of sec. 28, T. 4 N., R. 8 E.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine and medium granular structure; friable; common fine roots; neutral; clear smooth boundary.

Bt1—8 to 13 inches; dark yellowish brown (10YR 4/4) silt loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; thin patchy dark brown (10YR 4/3) clay films on faces of peds and in channels; slightly acid; clear smooth boundary.

Bt2—13 to 30 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; few fine very dark grayish brown (10YR 3/2) iron and manganese oxide accumulations; strongly acid; gradual smooth boundary.

Bt3—30 to 36 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; few fine very dark grayish brown (10YR 3/2) iron and manganese oxide accumulations; strongly acid; gradual smooth boundary.

2Bt4—36 to 46 inches; yellowish brown (10YR 5/6) loam; weak coarse subangular blocky structure; friable; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; gradual smooth boundary.

2C—46 to 60 inches; yellowish brown (10YR 5/4) loam and sandy loam; common fine faint pale brown (10YR 6/3) mottles; massive; friable; about 5 percent pebbles 3/4 inch to 3 inches across; medium acid.

The thickness of the solum ranges from 42 to 72 inches. The thickness of the loess ranges from 24 to 40 inches.

The Ap horizon has value of 4 or 5 and chroma of 3 or 4. It is medium acid to neutral.

The Bt1 horizon has value of 4 or 5 and chroma of 4 to 6. It is loam, silt loam, or silty clay loam and is medium acid or slightly acid. The Bt2 and Bt3 horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. They are very strongly acid to slightly acid.

The 2Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is loam, clay loam, sandy clay loam, or silty clay loam. It is very strongly acid or strongly acid.

The 2C horizon is sandy loam, loam, silty clay loam, or silt loam. It is very strongly acid to medium acid.

Grayford Series

The Grayford series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in a thin layer of loess, in glacial drift of pre-Illinoian age, and in material weathered from the underlying limestone bedrock. Slopes range from 6 to 18 percent.

Grayford soils are similar to Crider Variant and Ryker soils and generally are adjacent to Beasley, Caneyville, and Wirt soils. Crider Variant soils formed in loess and in the underlying limestone bedrock residuum and do not have glacial drift in the solum. Ryker soils are deeper than the Grayford soils, formed in thicker layers of loess and drift, and have a thicker solum. The subsoil of Beasley and Caneyville soils is finer textured than that of the Grayford soils. Beasley soils formed in material weathered from interbedded limestone and calcareous shale and siltstone. They are on the slightly lower side slopes. Caneyville soils formed in limestone bedrock residuum. They are in positions on the landscape similar to those of the Grayford soils. Wirt soils formed in silty and loamy alluvium on flood plains. Their solum contains less clay than that of the Grayford soils.

Typical pedon of Grayford silt loam, 12 to 18 percent slopes, eroded, in a pasture; 750 feet west and 1,130 feet north of the southeast corner of sec. 29, T. 4 N., R. 9 E.

Ap—0 to 6 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; mixed with a small amount of strong brown silt loam; weak medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

BE—6 to 12 inches; strong brown (7.5YR 5/6) silt loam; weak medium subangular blocky structure; friable; common fine roots; medium acid; gradual smooth boundary.

Bt1—12 to 22 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky

structure; friable; few fine roots; thin discontinuous reddish brown (5YR 4/4) clay films on faces of peds; few fine very dark gray (10YR 3/1) iron and manganese oxide accumulations; very strongly acid; gradual wavy boundary.

2Bt2—22 to 33 inches; yellowish red (5YR 5/6) loam; moderate medium angular and subangular blocky structure; firm; thin discontinuous reddish brown (5YR 4/4) clay films on faces of peds and in channels; many medium very dark gray (10YR 3/1) iron and manganese oxide accumulations; few pebbles; very strongly acid; gradual wavy boundary.

2Bt3—33 to 45 inches; yellowish red (5YR 5/6) clay loam; moderate medium subangular blocky structure; firm; thin discontinuous reddish brown (5YR 4/4) clay films on faces of peds and in channels; many medium very dark gray (10YR 3/1) iron and manganese oxide accumulations; few pebbles; strongly acid; gradual wavy boundary.

3BC—45 to 52 inches; reddish brown (5YR 4/4) clay; weak coarse angular blocky structure; very firm; many medium very dark gray (10YR 3/1) iron and manganese oxide accumulations; about 3 percent coarse chert fragments 3/4 inch to 3 inches across and 10 percent 3 to 10 inches across; medium acid; abrupt wavy boundary.

3R—52 inches; limestone bedrock.

The thickness of the solum and the depth to bedrock range from 40 to 60 inches. The thickness of the loess ranges from 6 to 24 inches. Clayey residuum generally is at a depth of 30 to 55 inches, but in some pedons the drift directly overlies the bedrock.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. The A horizon, where it remains, has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. It is strongly acid to neutral. Some pedons have an E horizon, which has hue of 10YR, value of 5 or 6, and chroma of 3 or 4.

The Bt horizon has hue of 5YR, 7.5YR, or 10YR; value of 4 or 5; and chroma of 4 to 8. It is silt loam or silty clay loam and is very strongly acid to neutral. The 2Bt horizon has hue of 5YR, 7.5YR, or 10YR; value of 4 or 5; and chroma of 4 to 8. It is loam, silt loam, clay loam, or silty clay loam and is strongly acid or very strongly acid. Some pedons have a 3Bt horizon. The horizon has hue of 2.5YR to 7.5YR, value of 3 to 5, and chroma of 3 to 8. It is silty clay loam, silty clay, or clay and is strongly acid to neutral.

The 3BC horizon, where present, has hue of 2.5YR to 7.5YR, value of 3 to 5, and chroma of 3 to 8. It is silty clay loam, silty clay, or clay and is strongly acid to slightly acid. The chert fragments in this horizon range from 5 to 35 percent.

Haymond Series

The Haymond series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in silty alluvium washed dominantly from loess-covered uplands. Slopes range from 0 to 2 percent.

Haymond soils are similar to Wirt soils and in some areas are adjacent to Pekin soils. Wirt soils have more sand and less silt in the subsoil than the Haymond soils. Pekin soils formed in acid, silty material of mixed origin and have a fragipan. They are on stream terraces.

Typical pedon of Haymond silt loam, occasionally flooded, in a cultivated field; 600 feet west of the center of sec. 9, T. 4 N., R. 8 E.

Ap—0 to 10 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium granular and subangular blocky structure; friable; common fine roots; neutral; abrupt smooth boundary.

Bw1—10 to 24 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium subangular blocky structure; friable; few fine roots; patchy dark brown (10YR 4/3) coatings on faces of peds; neutral; gradual wavy boundary.

Bw2—24 to 33 inches; dark brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; few fine roots; patchy dark brown (10YR 4/3) coatings on faces of peds; neutral; gradual wavy boundary.

Bw3—33 to 43 inches; dark brown (10YR 4/3) silt loam; few fine distinct light yellowish brown (10YR 6/4) mottles; weak medium subangular blocky structure; friable; discontinuous dark brown (10YR 3/3) coatings on faces of peds; neutral; clear wavy boundary.

C1—43 to 57 inches; dark yellowish brown (10YR 4/4) silt loam; few fine distinct brownish yellow (10YR 6/6) and many medium distinct pale brown (10YR 6/3) mottles; massive; friable; neutral; gradual wavy boundary.

C2—57 to 60 inches; dark brown (10YR 4/3) silt loam; common medium distinct light brownish gray (10YR 6/2) and brownish yellow (10YR 6/6) mottles; massive; friable; neutral.

The solum ranges from 40 to 50 inches in thickness. It is slightly acid or neutral. The Ap horizon has value of 4 or 5 and chroma of 2 to 4. The Bw horizon has value of 4 to 6 and chroma of 3 or 4. The C horizon is silt loam, loam, or fine sandy loam.

Hickory Series

The Hickory series consists of deep, well drained, moderately permeable soils on glacial drift plains. These soils formed in loess and in the underlying glacial drift. Slopes range from 6 to 45 percent.

Hickory soils are similar to Bonnell soils and generally are adjacent to Cincinnati soils. Bonnell soils have more clay and less sand in the subsoil than the Hickory soils. Cincinnati soils are in the less sloping, slightly higher areas. They have a fragipan. Their loess cap and solum are thicker than those of the Hickory soils.

Typical pedon of Hickory silt loam, 18 to 45 percent slopes, in a wooded area; 750 feet south and 1,600 feet west of the northeast corner of sec. 2, T. 4 N., R. 8 E.

A—0 to 2 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium granular structure; friable; many fine roots; neutral; abrupt wavy boundary.

E—2 to 4 inches; yellowish brown (10YR 5/4) silt loam, very pale brown (10YR 7/3) dry; weak fine subangular blocky structure; friable; many fine roots; neutral; clear wavy boundary.

EB—4 to 9 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; common medium roots; medium acid; gradual wavy boundary.

2Bt1—9 to 18 inches; yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; firm; common fine roots; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; few pebbles less than three-quarters of an inch across; strongly acid; gradual wavy boundary.

2Bt2—18 to 26 inches; strong brown (7.5YR 5/6) clay loam; moderate medium subangular blocky structure; firm; thin discontinuous strong brown (7.5YR 4/6) clay films on faces of peds; few pebbles less than three-quarters of an inch across; strongly acid; gradual wavy boundary.

2Bt3—26 to 36 inches; dark yellowish brown (10YR 4/4) clay loam; few medium faint light yellowish brown (10YR 6/4) mottles; moderate medium subangular blocky structure; firm; common medium roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; few fine very dark gray (N 3/0) iron and manganese oxide accumulations; few pebbles less than three-quarters of an inch across; strongly acid; gradual wavy boundary.

2BC—36 to 54 inches; yellowish brown (10YR 5/4) clay loam; many medium faint yellowish brown (10YR 5/6) mottles; weak medium angular blocky structure; firm; few medium roots; thin discontinuous dark brown (10YR 4/3) clay films on faces of peds; few fine very dark gray (N 3/0) iron and manganese oxide accumulations; few pebbles less than three-quarters of an inch across; neutral; gradual wavy boundary.

2C—54 to 60 inches; dark yellowish brown (10YR 4/4) loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak medium angular blocky structure; firm; few medium roots; few fine very dark gray (N 3/0) iron and manganese oxide accumulations; few pebbles less than three-quarters of an inch across; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 40 to 72 inches. The thickness of the loess ranges from 3 to 20 inches.

The A horizon has value of 2 to 4. The E horizon has value of 4 to 6 and chroma of 2 to 4. It is loam or silt loam and is very strongly acid to neutral.

The EB and 2Bt horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. In some pedons the 2Bt horizon has mottles with value of 5 or 6 and chroma of 2 to 8 in the lower part. It is clay loam or silty clay loam and is very strongly acid to medium acid.

The 2BC horizon has hue of 10YR, 7.5YR, or 2.5Y and chroma of 2 to 6 and in some pedons is distinctly mottled. It is clay loam, gravelly clay loam, or loam.

The 2C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4 and is mottled in most pedons. It is loam or sandy loam. In some pedons the content of fine gravel in this horizon is, by volume, as much as 20 percent.

Holton Series

The Holton series consists of deep, somewhat poorly drained, moderately permeable soils on flood plains. These soils formed in alluvium derived from soils that formed in glacial drift. Slopes range from 0 to 2 percent.

Holton soils generally are adjacent to Cincinnati soils. The adjacent soils formed in loess and the underlying glacial drift and have a fragipan. They are on summits, shoulder slopes, and back slopes in the uplands.

Typical pedon of Holton loam, occasionally flooded, in a pasture; 100 feet east and 600 feet south of the northwest corner of sec. 1, T. 3 N., R. 9 E.

Ap—0 to 8 inches; grayish brown (10YR 5/2) loam, light brownish gray (10YR 6/2) dry; common fine distinct dark yellowish brown (10YR 4/6) mottles; moderate thick platy structure; friable; many fine roots; neutral; abrupt smooth boundary.

Bw—8 to 16 inches; dark brown (10YR 4/3) loam; common fine faint pale brown (10YR 6/3) and grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; common fine roots; neutral; abrupt smooth boundary.

Bg1—16 to 19 inches; grayish brown (10YR 5/2) loamy sand; few fine faint dark grayish brown (10YR 4/2) and light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; few fine roots; neutral; abrupt wavy boundary.

Bg2—19 to 32 inches; dark gray (10YR 4/1) fine sandy loam; weak medium subangular blocky structure; friable; about 5 percent coarse fragments; neutral; gradual wavy boundary.

Cg1—32 to 45 inches; dark gray (10YR 4/1) sandy loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; about 10 percent coarse fragments; neutral; gradual wavy boundary.

Cg2—45 to 60 inches; dark gray (10YR 4/1) sandy clay loam; many medium distinct yellowish brown (10YR 5/8) and common medium faint gray (10YR 6/1) mottles; massive; slightly sticky; about 10 percent coarse fragments, 2 percent 3/4 inch to 3 inches across; neutral.

The control section is medium acid to neutral, and free carbonates are below a depth of 40 inches in some pedons. The content of coarse fragments is, by volume, as much as 15 percent to a depth of 60 inches.

The Ap and Bw horizons have value of 4 or 5 and chroma of 2 or 3. They are silt loam or loam. Layers of loamy sand or sand are within 20 inches of the surface in most pedons. The Bg horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 to 3. It is loam, silt loam, clay loam, sandy loam, loamy sand, fine sandy loam, or silty clay loam.

The Cg horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 to 4. It is loam, clay loam, sandy loam, or sandy clay loam and is slightly acid or neutral.

Huntington Series

The Huntington series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in silty recent alluvium that is of mixed origin and that has limestone as a significant component. Slopes range from 0 to 2 percent.

Huntington soils are similar to Dearborn soils and generally are adjacent to Elkinsville, Pate, and Wirt soils. Dearborn soils have more channers and flagstones throughout than the Huntington soils. Elkinsville soils formed in loess and the underlying stratified silty or loamy material on terraces. Their surface layer is lighter colored than that of the Huntington soils. Pate soils formed in material weathered from interbedded limestone and calcareous shale on foot slopes and have more clay in the solum than the Huntington soils. Wirt soils formed in loamy and silty, medium acid to neutral alluvium derived from soils that formed in glacial drift. They have less clay and more sand in the solum than the Huntington soils.

Typical pedon of Huntington silt loam, occasionally flooded, in a cultivated field; 950 feet east and 1,000 feet south of the center of sec. 7, T. 3 N., R. 10 E.

Ap—0 to 3 inches; dark brown (10YR 3/3) silt loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

A—3 to 17 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak coarse subangular blocky structure; friable; common fine roots; very dark grayish brown (10YR 3/2) coatings on faces of peds; neutral; gradual smooth boundary.

Bw1—17 to 26 inches; dark brown (10YR 4/3) silty clay loam; weak medium subangular blocky structure; firm; common fine roots; grayish brown (10YR 5/2) coatings on faces of peds; neutral; gradual smooth boundary.

Bw2—26 to 38 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; brown (10YR 5/3) coatings on faces of peds; neutral; clear smooth boundary.

Bw3—38 to 57 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak medium subangular blocky structure; firm; few fine roots; brown (10YR 5/3) coatings on faces of peds; few mica flakes; neutral; clear smooth boundary.

C—57 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; few medium distinct light brownish gray (10YR 6/2) mottles; massive; firm; few mica flakes; neutral.

The thickness of the solum ranges from 50 to 70 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches. Mica flakes are common in many pedons.

The Ap and A horizons have value and chroma of 2 or 3. They are silt loam, silty clay loam, or loam and are medium acid to neutral. The Bw horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or silty clay loam and is medium acid to neutral. The C horizon is loam, sandy loam, silt loam, or silty clay loam.

Jennings Series

The Jennings series consists of deep, moderately well drained, very slowly permeable soils on uplands. These soils formed in a thin layer of loess, in glacial drift, and in the underlying material weathered from black shale. Slopes range from 2 to 12 percent.

Jennings soils are similar to Cincinnati and Rossmoyne soils and generally are adjacent to Deputy and Trappist soils. Cincinnati and Rossmoyne soils formed in loess and the underlying glacial drift. They are deeper to bedrock than the Jennings soils. Deputy and Trappist soils formed in a thin layer of loess and in the underlying material weathered from shale bedrock. They do not have a fragipan.

Typical pedon of Jennings silt loam, 2 to 6 percent slopes, eroded, in a cultivated field; 300 feet west and 400 feet south of the northeast corner of sec. 20, T. 3 N., R. 9 E.

Ap—0 to 8 inches; dark yellowish brown (10YR 4/4) silt loam mixed with a small amount of strong brown (7.5YR 5/6) silty clay loam; light yellowish brown

(10YR 6/4) dry; weak fine and medium granular structure; friable; common fine roots; neutral; abrupt smooth boundary.

Bt1—8 to 12 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; few fine roots; thin discontinuous brown (7.5YR 5/4) clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—12 to 19 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few fine roots; thin discontinuous brown (7.5YR 5/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt3—19 to 27 inches; yellowish brown (10YR 5/6) silt loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; few fine roots on faces of prisms; thin discontinuous dark brown (7.5YR 4/4) and thin patchy brown (10YR 5/3) clay films on faces of peds; discontinuous light brownish gray (10YR 6/2) silt coatings on faces of prisms and blocks; very strongly acid; gradual wavy boundary.

2Btx1—27 to 44 inches; yellowish brown (10YR 5/4) silt loam; strong very coarse prismatic structure parting to moderate medium angular blocky; very firm; brittle in more than 60 percent of the volume; thin discontinuous reddish brown (5YR 4/4) and dark brown (7.5YR 4/4) clay films on faces of peds; continuous grayish brown (10YR 5/2) silt coatings on faces of prisms and blocks; few pebbles; very strongly acid; gradual wavy boundary.

2Btx2—44 to 51 inches; yellowish brown (10YR 5/6) silty clay loam; common fine distinct light yellowish brown (10YR 6/4) mottles; moderate coarse prismatic structure parting to weak medium subangular blocky; firm; brittle in 50 to 60 percent of the volume; common light gray (10YR 7/2) silt flows in channels; few pebbles; extremely acid; gradual wavy boundary.

3BC—51 to 62 inches; strong brown (7.5YR 5/6) silty clay; common fine distinct very pale brown (10YR 7/4) mottles; weak thick platy structure; firm; common light gray (10YR 7/2) silt flows in channels; extremely acid; gradual wavy boundary.

3C—62 to 68 inches; brownish yellow (10YR 6/6) silty clay loam; many coarse distinct light brownish gray (10YR 6/2) mottles; massive; firm; about 5 percent black shale fragments; extremely acid; abrupt smooth boundary.

3R—68 inches; hard black shale bedrock.

The thickness of the solum ranges from 48 to 72 inches. The depth to the fragipan ranges from 15 to 30 inches. The depth to clayey residuum ranges from 40 to 60 inches.

The Ap horizon has value of 3 to 5 and chroma of 2 to 4. It is dominantly silt loam but is silty clay loam in some pedons. It is strongly acid to neutral.

The Bt horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. It is very strongly acid or strongly acid. The 2Btx horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. It is loam, silt loam, silty clay loam, or clay loam and is extremely acid to strongly acid.

The 3BC and 3C horizons, if they occur, have hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. They are silty clay loam, silty clay, or clay and are extremely acid or very strongly acid.

Markland Series

The Markland series consists of deep, well drained and moderately well drained, slowly permeable soils on loess-covered lacustrine terraces. These soils formed in loess and in the underlying calcareous, clayey lacustrine sediments. Slopes range from 1 to 15 percent.

Markland soils are similar to Pate soils and generally are adjacent to Huntington soils. Pate soils are underlain by interbedded limestone and calcareous shale and are not so deep over bedrock as the Markland soils. Huntington soils formed in silty recent alluvium on flood plains and contain less clay than the Markland soils.

Typical pedon of Markland silt loam, 1 to 6 percent slopes, eroded, in a cultivated field; 100 feet north and 1,350 feet east of the center of sec. 25, T. 4 N., R. 12 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; mixed with a small amount of yellowish brown silty clay loam; moderate medium granular and weak fine subangular blocky structure; friable; many fine roots; neutral; abrupt smooth boundary.

2Bt1—7 to 18 inches; yellowish brown (10YR 5/4) silty clay; common fine distinct light yellowish brown (2.5YR 6/4) mottles; moderate medium subangular blocky structure; firm; common fine roots; thin discontinuous yellowish brown (10YR 5/4) clay films on faces of peds; medium acid; clear smooth boundary.

2Bt2—18 to 29 inches; yellowish brown (10YR 5/4) clay; few medium distinct white (10YR 8/2) mottles; strong coarse angular blocky structure; very firm; few fine roots; thin continuous grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/4) clay films on faces of peds; slightly acid; clear wavy boundary.

2C1—29 to 36 inches; yellowish brown (10YR 5/4) silty clay that has thin strata of silty clay loam; common fine distinct light brownish gray (2.5Y 6/2) and few medium distinct white (10YR 8/2) mottles; weak medium subangular blocky structure; very firm; few fine roots; thin discontinuous brown (10YR 5/3) clay

films on faces of peds; strong effervescence in spots; moderately alkaline; gradual wavy boundary.

2C2—36 to 46 inches; yellowish brown (10YR 5/4) silty clay that has thin strata of silty clay loam; many medium distinct white (10YR 8/2) mottles; massive; very firm; few fine roots; strong effervescence; moderately alkaline; gradual wavy boundary.

2Cg—46 to 60 inches; light brownish gray (10YR 6/2) silty clay loam; common coarse distinct strong brown (7.5YR 5/8) and common medium distinct yellowish brown (10YR 5/6) mottles; massive; very firm; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 20 to 40 inches. The thickness of the loess ranges from 0 to 15 inches.

The Ap or A horizon has value of 4 or 5 and chroma of 2 to 4. It is silt loam or silty clay loam and is medium acid to neutral.

The 2Bt horizon has value of 4 or 5 and chroma of 3 or 4. It is silty clay loam, silty clay, or clay and is medium acid or slightly acid.

The 2C horizon has strata of fine sand, very fine sand, silt loam, silty clay loam, silty clay, or clay. It is mildly alkaline or moderately alkaline.

Negley Series

The Negley series consists of deep, well drained, moderately permeable soils on loess-covered valley trains. These soils formed in loess and in the underlying drift or outwash. Slopes range from 2 to 12 percent.

These soils have redder hue in the lower part of the solum and a lower content of coarse fragments than is defined for the Negley series. These differences, however, do not alter the usefulness or behavior of the soils.

Negley soils are similar to Elkinsville and Ryker soils and generally are adjacent to Wirt soils. Elkinsville soils have yellower hue in the lower part of the solum than the Negley soils. They are on stream terraces. Ryker soils formed in loess, in glacial drift, and in the underlying limestone bedrock residuum and have less sand in the upper part of the solum than the Negley soils. They are on summits, shoulder slopes, and back slopes in the uplands. Wirt soils formed in silty and loamy, medium acid to neutral alluvium on flood plains and contain less clay than the Negley soils.

Typical pedon of Negley silt loam, 2 to 6 percent slopes, eroded, in a cultivated field; 500 feet east and 1,200 feet north of the center of sec. 7, T. 4 N., R. 8 E.

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; mixed with a small amount of strong brown (7.5YR 5/6) silt loam; weak medium granular structure; friable; common fine roots; medium acid; abrupt smooth boundary.

Bt1—7 to 17 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common fine roots; thin patchy dark brown (7.5YR 4/4) clay films on faces of peds; strongly acid; clear smooth boundary.

2Bt2—17 to 25 inches; strong brown (7.5YR 5/6) loam; moderate medium subangular blocky structure; friable; common fine roots; thin patchy reddish brown (5YR 4/4) and thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; few pink (7.5YR 7/4) silt flows in channels; common fine dark brown (7.5YR 3/2) iron and manganese oxide accumulations; strongly acid; gradual wavy boundary.

2Bt3—25 to 40 inches; yellowish red (5YR 5/6) clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous reddish brown (5YR 4/4) clay films on faces of peds; common fine dark reddish brown (5YR 3/2) iron and manganese oxide accumulations; strongly acid; gradual wavy boundary.

2Bt4—40 to 51 inches; yellowish red (5YR 5/6) clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous reddish brown (5YR 4/4) clay films and patchy light brown (7.5YR 6/4) silt coatings on faces of peds; many fine dark reddish brown (5YR 3/2) iron and manganese oxide accumulations; strongly acid; gradual wavy boundary.

2Bt5—51 to 63 inches; red (2.5YR 4/6) clay loam; moderate medium angular blocky structure; firm; thin patchy reddish brown (5YR 4/3) clay films and patchy light brown (7.5YR 6/4) silt coatings on faces of peds; common fine dark reddish brown (5YR 3/2) iron and manganese oxide accumulations; strongly acid; gradual wavy boundary.

2BC—63 to 80 inches; red (2.5YR 4/6) sandy clay loam; weak coarse subangular blocky structure; firm; thin patchy red (2.5YR 4/6) clay films and patchy light reddish brown (5YR 6/4) silt coatings on faces of peds; common medium dark reddish brown (5YR 3/2) iron and manganese oxide accumulations; strongly acid.

The thickness of the solum ranges from 80 to 150 inches. The loess is 10 to 18 inches thick.

The Ap horizon has value of 3 to 5 and chroma of 2 to 4. It is strongly acid to slightly acid unless limed.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam, loam, or silty clay loam and is very strongly acid or strongly acid.

The 2Bt2, 2Bt3, and 2Bt4 horizons have hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. They are loam or clay loam and are very strongly acid or strongly acid. The 2Bt5 horizon has value of 3 to 5 and chroma of 3 to 6. It is very strongly acid or strongly acid.

The 2BC horizon has hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam, sandy clay loam, or sandy loam and is strongly acid or medium acid.

Nicholson Series

The Nicholson series consists of deep, moderately well drained, slowly permeable soils on uplands. These soils formed in loess and in the underlying clayey material weathered from limestone and shale. Slopes range from 2 to 6 percent.

Nicholson soils are similar to Cincinnati and Rossmoyne soils and generally are adjacent to Switzerland soils. Cincinnati and Rossmoyne soils formed in loess and the underlying glacial drift on summits, shoulder slopes, and back slopes and are deeper over bedrock than the Nicholson soils. Switzerland soils do not have a fragipan. They are in positions on the landscape similar to those of the Nicholson soils.

Typical pedon of Nicholson silt loam, 2 to 6 percent slopes, eroded, in a hayfield; 800 feet east and 900 feet south of the northwest corner of sec. 29, T. 4 N., R. 11 E.

Ap—0 to 8 inches; dark yellowish brown (10YR 4/4) silt loam, very pale brown (10YR 7/3) dry; mixed with a small amount of yellowish brown (10YR 5/6) silty clay loam; moderate medium granular structure; friable; common medium and fine roots; slightly acid; abrupt smooth boundary.

Bt1—8 to 17 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; common fine roots; thin discontinuous strong brown (7.5YR 4/6) clay films on faces of peds; medium acid; clear smooth boundary.

Bt2—17 to 26 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable; common fine roots; thin discontinuous brown (7.5YR 5/4) clay films on faces of peds; medium acid; gradual smooth boundary.

Bx—26 to 42 inches; strong brown (7.5YR 5/6) silty clay loam; many medium distinct light gray (10YR 7/2) mottles; strong very coarse prismatic structure parting to moderate medium and coarse subangular blocky; very firm; brittle in more than 60 percent of the volume; thin discontinuous brown (7.5YR 5/4) clay films on faces of peds and in channels; strongly acid; gradual smooth boundary.

2Bt—42 to 56 inches; yellowish brown (10YR 5/6) clay; common medium prominent light brownish gray (2.5Y 6/2) mottles; moderate medium subangular blocky structure; very firm; thin continuous light yellowish brown (2.5YR 6/4) clay films on faces of peds; about 5 percent coarse fragments less than 3 inches in diameter; neutral; clear smooth boundary.

2BC—56 to 61 inches; light olive brown (2.5Y 5/4) clay; common medium distinct yellow (2.5Y 7/6) mottles; weak medium angular blocky structure; very firm; thin continuous light olive gray (5Y 6/2) clay films on faces of peds; slight effervescence; mildly alkaline; clear smooth boundary.

2Cg—61 to 72 inches; grayish brown (2.5Y 5/2) silty clay loam; common medium distinct light yellowish brown (2.5Y 6/4) mottles; many medium distinct white (5Y 8/1) calcareous stains; weak coarse subangular blocky structure; firm; strong effervescence; mildly alkaline; abrupt smooth boundary.

2R—72 inches; limestone bedrock.

The thickness of the solum ranges from 50 to 80 inches. The depth to limestone, calcareous shale, or siltstone is more than 60 inches. The thickness of the loess ranges from 30 to 48 inches.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. It is medium acid to neutral. Some pedons have a BE horizon.

The Bt horizon is strong brown (7.5YR 5/6) or yellowish brown (10YR 5/6). It is silt loam or silty clay loam and is strongly acid or medium acid. The Bx horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 8 and is mottled. It is silt loam or silty clay loam and is very strongly acid or strongly acid.

The 2Bt horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 4 to 6. It is silty clay or clay and is slightly acid or neutral. The content of coarse fragments in this horizon ranges from 0 to 10 percent.

The 2BC and 2Cg horizons have hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 4 to 6. They are medium acid to mildly alkaline. They are silty clay or clay. The content of coarse fragments in these horizons ranges from 0 to 10 percent.

Pate Series

The Pate series consists of deep, well drained, very slowly permeable soils on uplands. These soils formed in material weathered from interbedded limestone and soft, gray, calcareous shale. The shale predominates. Slopes range from 18 to 35 percent.

Pate soils are similar to Eden and Markland soils and generally are adjacent to Dearborn and Huntington soils. Eden soils are moderately deep over bedrock. They are on back slopes. Markland soils formed in loess and the underlying calcareous, clayey lacustrine sediments on terraces and are deeper over bedrock than the Pate soils. Dearborn and Huntington soils formed in alluvium on flood plains and contain less clay than the Pate soils.

Typical pedon of Pate silty clay loam, 18 to 35 percent slopes, in a cultivated field; 100 feet west and 440 feet south of the northeast corner of sec. 25, T. 4 N., R. 12 E.

Ap—0 to 8 inches; dark brown (10YR 4/3) silty clay loam, pale brown (10YR 6/3) dry; mixed with a small amount of yellowish brown (10YR 5/4) silty clay loam; moderate medium granular and subangular blocky structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

Bt1—8 to 12 inches; yellowish brown (10YR 5/4) silty clay loam; weak medium prismatic structure parting to moderate medium subangular blocky; firm; many fine roots; thin patchy dark brown (10YR 4/3) clay films on faces of peds; slightly acid; clear smooth boundary.

Bt2—12 to 19 inches; yellowish brown (10YR 5/4) silty clay; moderate coarse prismatic structure parting to moderate coarse subangular blocky; very firm; common fine roots; thin discontinuous dark brown (10YR 4/3) clay films on faces of peds; medium acid; gradual wavy boundary.

Bt3—19 to 30 inches; yellowish brown (10YR 5/4) clay; moderate coarse prismatic structure parting to moderate medium angular and subangular blocky; very firm; common fine roots; thin patchy olive (5Y 5/3) and thin discontinuous olive brown (2.5Y 4/4) clay films on faces of peds; medium acid; gradual wavy boundary.

Bt4—30 to 42 inches; light olive brown (2.5Y 5/4) clay; moderate medium angular blocky structure; very firm; few fine roots; thin discontinuous olive (5Y 5/3) and olive brown (2.5Y 4/4) clay films on faces of peds; few olive (5Y 5/3) and olive brown (2.5Y 4/4) slickensides; few very dark grayish brown (10YR 3/2) manganese oxide accumulations; neutral; gradual wavy boundary.

Bt5—42 to 50 inches; light olive brown (2.5Y 5/4) clay; weak medium angular and subangular blocky structure; very firm; few fine roots; thin patchy light olive brown (2.5Y 5/4) clay films on faces of peds; neutral; gradual wavy boundary.

BC—50 to 65 inches; light olive brown (2.5Y 5/6) flaggy clay; weak medium angular and subangular blocky structure; very firm; about 20 percent coarse fragments; strong effervescence; moderately alkaline; clear wavy boundary.

Cr—65 to 80 inches; interbedded limestone and gray, calcareous shale.

The thickness of the solum and the depth to carbonates range from 50 to 72 inches. The content of coarse fragments ranges from 0 to 10 percent in the upper part of the solum and from 15 to 50 percent in the lower part.

The Ap horizon has value and chroma of 3 or 4. It is silt loam or silty clay loam and is medium acid to neutral.

The Bt1 horizon has value of 4 or 5 and chroma of 3 or 4. It is silt loam or silty clay loam and is medium acid to neutral. The other Bt horizons have hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. They are silty clay, clay, or silty clay loam, or the flaggy analogs of these textures. They are medium acid to neutral.

The BC horizon is silty clay, clay, or the channery or flaggy analogs of these textures. It is neutral to moderately alkaline.

Pekin Series

The Pekin series consists of deep, moderately well drained, very slowly permeable soils on stream terraces. These soils formed in acid, silty material of mixed origin. Slopes range from 1 to 4 percent.

These soils have a lower base saturation than is defined for the Pekin series. This difference, however, does not alter the usefulness or behavior of the soils.

Pekin soils are similar to Rossmoyne soils and are adjacent to Elkinsville and Haymond soils in some areas. Rossmoyne soils formed in loess and the underlying glacial drift and do not have a stratified substratum. They are on summits, shoulder slopes, and upper back slopes in the uplands. Elkinsville soils do not have a fragipan or gray mottles in the upper part of the subsoil. They are in the slightly higher positions on the landscape. Haymond soils formed in alluvium on flood plains and do not have a fragipan.

Typical pedon of Pekin silt loam, 1 to 4 percent slopes, rarely flooded, in a hayfield; 350 feet east and 1,200 feet north of the center of sec. 28, T. 4 N., R. 8 E.

Ap—0 to 7 inches; dark yellowish brown (10YR 4/4) silt loam, very pale brown (10YR 7/3) dry; weak fine subangular blocky and weak medium granular structure; friable; common fine roots; neutral; abrupt smooth boundary.

BE—7 to 14 inches; yellowish brown (10YR 5/6) silt loam; few fine distinct pale brown (10YR 6/3) mottles; weak fine and medium subangular blocky structure; friable; common fine roots; strongly acid; clear smooth boundary.

Bt—14 to 25 inches; yellowish brown (10YR 5/6) silt loam; many medium distinct light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) mottles; moderate medium and coarse subangular blocky structure; friable; few very fine roots; thin discontinuous yellowish brown (10YR 5/4) clay films on faces of peds; strongly acid; gradual smooth boundary.

Btx—25 to 39 inches; yellowish brown (10YR 5/6) silty clay loam; many medium distinct light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) mottles; very coarse prismatic structure parting to moderate coarse subangular blocky; very firm; brittle in more than 60 percent of the volume; thin discontinuous light brownish gray (10YR 6/2) and grayish brown (10YR 5/2) clay films on faces of peds; light brownish gray (10YR 6/2) silt flows in channels; few medium very dark brown (10YR 2/2) iron and

manganese oxide accumulations; very strongly acid; gradual wavy boundary.

Bx—39 to 57 inches; yellowish brown (10YR 5/6) silt loam; common medium distinct strong brown (7.5YR 5/6) mottles; strong very coarse prismatic structure parting to weak medium and coarse subangular blocky in the upper part and parting to weak medium and thick platy in the lower part; very firm; brittle in more than 60 percent of the volume; discontinuous light brownish gray (10YR 6/2) silt flows in channels; very strongly acid; gradual smooth boundary.

C—57 to 60 inches; brownish yellow (10YR 6/6) silt loam; thin strata of loam and fine sandy loam in the lower part; massive; firm; strongly acid.

The thickness of the solum ranges from 48 to 60 inches. The Ap horizon has value of 4 or 5 and chroma of 3 or 4. It is medium acid to neutral. The Bt horizon has chroma of 3 to 6 and is mottled. It is silt loam or silty clay loam and is very strongly acid or strongly acid. The Btx and Bx horizons have value of 5 or 6 and chroma of 2 to 8 and are mottled. They are very strongly acid or strongly acid.

The C horizon has value of 5 or 6 and chroma of 2 to 6. It is silt loam, loam, or silty clay loam and is stratified in the lower part. It is very strongly acid to neutral.

Rahm Series

The Rahm series consists of deep, somewhat poorly drained, slowly permeable soils on high bottoms on flood plains or low terraces. These soils formed in neutral or slightly acid, silty alluvium 20 to 36 inches deep over a buried soil, which formed in acid, silty alluvium. Slopes range from 0 to 2 percent.

Rahm soils generally are adjacent to Huntington soils. The adjacent soils are well drained and are on the lower lying bottoms on flood plains adjacent to streams. Their surface layer is darker than that of the Rahm soils, and the lower part of their subsoil contains less clay.

Typical pedon of Rahm silty clay loam, occasionally flooded, in a cultivated field; 1,600 feet north and 1,500 feet east of the southwest corner of sec. 31, T. 4 N., R. 4 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silty clay loam, light gray (10YR 7/2) dry; weak medium granular structure; friable; few fine roots; neutral; clear smooth boundary.

A—6 to 10 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine faint grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; firm; few fine roots; neutral; abrupt smooth boundary.

Bg—10 to 25 inches; grayish brown (10YR 5/2) silty clay loam; many fine distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; few fine roots; slightly acid; gradual wavy boundary.

Btgb—25 to 38 inches; grayish brown (10YR 5/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) and common fine faint brown (10YR 5/3) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; firm; thin patchy light brownish gray (10YR 6/2) clay films on faces of peds; strongly acid; gradual wavy boundary.

Btb1—38 to 48 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct light brownish gray (10YR 6/2) and common medium distinct strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium and coarse subangular blocky; firm; thin patchy light brownish gray (10YR 6/2) clay films on faces of peds; strongly acid; gradual wavy boundary.

Btb2—48 to 59 inches; yellowish brown (10YR 5/4) silty clay; many medium distinct light brownish gray (10YR 6/2) and common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; very firm; thin discontinuous light brownish gray (10YR 6/2) clay films on faces of peds; strongly acid; gradual wavy boundary.

Btb3—59 to 78 inches; dark yellowish brown (10YR 4/6) silty clay loam; many medium distinct gray (10YR 5/1) and common medium distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; thin patchy light brownish gray (10YR 6/2) clay films on faces of peds; medium acid; gradual wavy boundary.

C—78 to 80 inches; dark yellowish brown (10YR 4/6) silty clay loam; many medium distinct gray (10YR 5/1) and common medium distinct strong brown (7.5YR 5/6) mottles; massive; very firm; medium acid.

The thickness of the solum ranges from 45 to 72 inches. The Ap and A horizons have value of 4 or 5 and chroma of 2 to 4. They are silt loam or silty clay loam and are slightly acid or neutral.

The Bg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 6 and is distinctly mottled. It is silt loam or silty clay loam in the upper part and silty clay loam or silty clay in the lower part. It is slightly acid or neutral in the upper part and strongly acid or medium acid in the lower part.

The Btgb horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6, and chroma of 2 and is distinctly mottled. It is silty clay loam, silty clay, or silt loam. It is very strongly acid to medium acid. The Btb horizon is similar to the Btgb horizon but has higher chroma.

The C horizon is silt loam, silty clay loam, or silty clay. It is stratified in some pedons.

Rossmoyne Series

The Rossmoyne series consists of deep, moderately well drained, slowly permeable soils on glacial drift plains. These soils formed in a thin layer of loess and in the underlying glacial drift. Slopes range from 0 to 6 percent.

Rossmoyne soils are similar to Cincinnati, Jennings, and Nicholson soils and generally are adjacent to Avonburg soils. Cincinnati soils do not have gray mottles in the upper part of the subsoil. Jennings soils formed in a thin layer of loess, in glacial drift, and in the underlying material weathered from black shale bedrock. They have more clay in the lower part of the solum than the Rossmoyne soils. Nicholson soils formed in loess and the underlying clayey material weathered from limestone and shale bedrock. They are shallower over bedrock than the Rossmoyne soils. Avonburg soils are grayer in the upper part than the Rossmoyne soils. They are on the higher, less sloping parts of the landscape.

Typical pedon of Rossmoyne silt loam, 2 to 6 percent slopes, eroded, in a cultivated field; 1,050 feet west and 1,580 feet north of the southeast corner of sec. 28, T. 4 N., R. 10 E.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; mixed with a small amount of yellowish brown (10YR 5/6) silt loam; weak medium granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

BE—8 to 14 inches; yellowish brown (10YR 5/6) silt loam; common medium faint yellowish brown (10YR 5/4) mottles; weak fine and medium subangular blocky structure; friable; few fine roots; slightly acid; clear smooth boundary.

Bt—14 to 25 inches; yellowish brown (10YR 5/6) silt loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; few fine roots; thin discontinuous dark brown (10YR 4/3) clay films on faces of peds; patchy pale brown (10YR 6/3) silt coatings on vertical faces of peds; strongly acid; clear wavy boundary.

2Btx1—25 to 35 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct gray (10YR 6/1) and strong brown (7.5YR 5/6) mottles; strong very coarse prismatic structure parting to moderate medium angular blocky; very firm; brittle in more than 60 percent of the volume; few fine roots on faces of prisms; thin discontinuous dark brown (10YR 4/3) clay films inside prisms; pale brown (10YR 6/3) silt coatings on faces of prisms; few pebbles; strongly acid; gradual wavy boundary.

2Btx2—35 to 47 inches; yellowish brown (10YR 5/4) silt loam; few medium distinct strong brown (7.5YR 5/6) mottles; weak very coarse prismatic structure parting to weak medium subangular blocky; very firm; brittle in more than 60 percent of the volume; thin patchy grayish brown (10YR 5/2) clay films on faces of prisms and in pores; few very dark grayish brown (10YR 3/2) iron and managanese oxide accumulations; few pebbles; very strongly acid; gradual wavy boundary.

2Bw—47 to 80 inches; yellowish brown (10YR 5/4) silt loam; many medium distinct strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; firm; few fine black (10YR 2/1) iron and manganese oxide accumulations; few pebbles; strongly acid.

The thickness of the solum and the depth to carbonates range from 60 to 120 inches. The thickness of loess ranges from 18 to 40 inches. The depth to clay residuum ranges from 72 inches to more than 12 feet.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. It is very strongly acid or strongly acid unless limed.

The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It has mottles with hue of 10YR, value of 5 or 6, and chroma of 2 or less. It is silt loam or silty clay loam and is very strongly acid or strongly acid.

The 2Btx horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It has mottles with hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 6. It is loam, silt loam, silty clay loam, or clay loam and is very strongly acid or strongly acid. The 2Bw horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. It is loam, clay loam, or silt loam.

Ryker Series

The Ryker series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess, in glacial drift of pre-Illinoian age, and in the underlying limestone bedrock residuum. Slopes range from 0 to 12 percent.

Ryker soils are similar to Crider Variant, Grayford, and Negley soils and in some areas are adjacent to Caneyville soils. Crider Variant soils formed in loess and the underlying limestone bedrock residuum and are shallower over bedrock than the Ryker soils. They are on summits and shoulder slopes. The layer of loess and the solum in Grayford soils are thinner than those in the Ryker soils. Also, the upper part of the solum contains more sand. Negley soils formed in loess and the underlying drift or outwash on valley trains and have more sand in the upper part of the solum than the Ryker soils. Caneyville soils formed in limestone bedrock residuum and are moderately deep over bedrock. They are on back slopes.

Typical pedon of Ryker silt loam, 0 to 2 percent slopes, in a cornfield; 950 feet south and 2,000 feet west of the northeast corner of sec. 24, T. 3 N., R. 9 E.

Ap—0 to 6 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common fine roots; neutral; abrupt smooth boundary.

EB—6 to 12 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure parting to weak medium granular; friable; common fine roots; neutral; clear smooth boundary.

Bt1—12 to 27 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; few fine roots; thin continuous dark brown (7.5YR 4/4) clay films on faces of peds; neutral; gradual wavy boundary.

Bt2—27 to 38 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; medium continuous dark brown (7.5YR 4/4) clay films on faces of peds; few thin very pale brown (10YR 7/3) silt coatings on faces of peds; very strongly acid; gradual wavy boundary.

2Bt3—38 to 58 inches; yellowish red (5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; medium continuous reddish brown (5YR 4/4) clay films in channels; few thin pale brown (10YR 6/3) silt coatings on faces of peds; few pebbles; very strongly acid; gradual wavy boundary.

2Bt4—58 to 67 inches; yellowish red (5YR 5/6) silty clay loam; massive; firm; thin discontinuous reddish brown (5YR 4/4) clay films in channels; common medium light yellowish brown (10YR 6/4) silt coatings in channels; few pebbles; very strongly acid; clear smooth boundary.

2Bt5—67 to 80 inches; yellowish red (5YR 5/6) silty clay loam; massive; firm; thin patchy reddish brown (5YR 4/4) clay films in channels; common medium light yellowish brown (10YR 6/4) silt coatings in channels; few pebbles; strongly acid.

The thickness of the solum ranges from 60 to more than 100 inches. The thickness of the loess ranges from 24 to 48 inches.

The Ap horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. It is strongly acid to neutral, depending on local liming practices.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is silt loam or silty clay loam. The upper part of this horizon is strongly acid to neutral, and the lower part is very strongly acid to medium acid.

The 2Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is loam, silt loam, silty clay loam, or clay loam and is very strongly acid to medium acid. The content of coarse fragments in this horizon ranges from 2 to 15 percent.

Some pedons have a 3B horizon. This horizon has hue of 2.5YR to 7.5YR, value of 3 to 5, and chroma of 4 to 6. It is silty clay loam, silty clay, or clay and is strongly acid to neutral. The content of coarse fragments in this horizon ranges from 5 to 35 percent.

Switzerland Series

The Switzerland series consists of deep, well drained soils on uplands. These soils formed in a thin layer of loess and in the underlying material weathered from interbedded limestone and gray, calcareous shale. The shale predominates. Permeability is moderate in the upper part of the solum and very slow in the lower part. Slopes range from 2 to 6 percent.

Switzerland soils are similar to Carmel soils and generally are adjacent to Nicholson soils. The layer of loess and the solum in Carmel soils are thinner than those in the Switzerland soils. Nicholson soils have a fragipan in the subsoil. They are on summits and shoulder slopes.

Typical pedon of Switzerland silt loam, 2 to 6 percent slopes, eroded, in a cultivated field; 600 feet south and 2,000 feet east of the center of sec. 20, T. 4 N., R. 12 E.

Ap—0 to 11 inches; dark brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; mixed with a small amount of yellowish brown (10YR 5/8) silty clay loam; weak medium granular structure; friable; many fine roots; medium acid; abrupt smooth boundary.

Bt1—11 to 26 inches; yellowish brown (10YR 5/8) silty clay loam; moderate medium subangular blocky structure; firm; many fine roots; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; patchy light yellowish brown (10YR 6/4) silt coatings in channels and on faces of peds; medium acid; abrupt smooth boundary.

2Bt2—26 to 40 inches; yellowish brown (10YR 5/8) silty clay; common medium distinct light brownish gray (10YR 6/2) mottles; moderate coarse angular blocky structure; very firm; few fine roots; thin discontinuous yellowish brown (10YR 5/6) clay films on faces of peds; strongly acid; abrupt smooth boundary.

2Bt3—40 to 56 inches; yellowish brown (10YR 5/6) clay; common medium distinct light brownish gray (10YR 6/2) mottles; moderate coarse angular blocky structure; very firm; few fine roots; thin patchy light olive brown (2.5Y 5/4) clay films on faces of peds; medium acid; clear smooth boundary.

2C1—56 to 70 inches; light olive brown (2.5Y 5/4) clay; massive; very firm; violent effervescence; moderately alkaline; abrupt wavy boundary.

2C2—70 to 80 inches; light olive brown (2.5Y 5/4) flaggy clay; massive; very firm; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 50 to 80 inches. The thickness of the loess ranges from 20 to 36 inches. The depth to interbedded limestone and

calcareous shale ranges from 60 to more than 80 inches.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. It is strongly acid to neutral.

The Bt1 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is silt loam or silty clay loam and is strongly acid to medium acid. The 2Bt horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 4 to 8. It is strongly acid or medium acid in the upper part and slightly acid to moderately alkaline in the lower part.

The 2C horizon has hue of 10YR to 5Y, value of 5 to 7, and chroma of 3 to 6. It is silty clay, clay, or flaggy clay.

Trappist Series

The Trappist series consists of moderately deep, well drained, slowly permeable soils on uplands. These soils formed in a thin layer of loess and in the underlying material weathered from black shale. Slopes range from 6 to 25 percent.

These soils have less clay in the C horizon than is defined for the Trappist series. This difference, however, does not alter the usefulness or behavior of the soils.

Trappist soils are similar to Deputy soils and generally are adjacent to Jennings soils. Deputy soils are deeper over shale bedrock than the Trappist soils. Jennings soils formed in a thin layer of loess, in glacial drift, and in the underlying material weathered from black shale. They have a fragipan.

Typical pedon of Trappist silt loam, 6 to 12 percent slopes, eroded, in an idle field; 300 feet north and 700 feet east of the center of sec. 17, T. 3 N., R. 9 E.

Ap—0 to 6 inches; dark brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; mixed with a small amount of strong brown (7.5YR 5/6) silty clay loam; weak fine granular structure; friable; many fine roots; medium acid; abrupt smooth boundary.

BE—6 to 11 inches; strong brown (7.5YR 5/6) silty clay loam; weak fine and medium subangular blocky structure; friable; common fine roots; extremely acid; clear smooth boundary.

Bt1—11 to 15 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin patchy dark brown (7.5YR 4/4) clay films on faces of peds; extremely acid; clear smooth boundary.

2Bt2—15 to 24 inches; yellowish brown (10YR 5/4) silty clay; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous strong brown (7.5YR 5/6) clay films and patchy very pale brown (10YR 7/3) silt coatings on faces of peds; about 3 percent shale fragments less than one-half inch in diameter; extremely acid; gradual wavy boundary.

2BC—24 to 31 inches; light yellowish brown (10YR 6/4) silty clay loam; common medium distinct light brownish gray (10YR 6/2) and few medium distinct strong brown (7.5YR 5/6) mottles; weak thick platy structure; firm; few fine roots; about 3 percent shale fragments less than one-half inch in diameter; extremely acid; gradual wavy boundary.

2C—31 to 38 inches; light brownish gray (10YR 6/2) shaly silty clay loam; many medium distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; moderate thick platy structure; firm; about 30 percent shale fragments; extremely acid; abrupt smooth boundary.

2R—38 inches; hard black shale bedrock.

The thickness of the solum ranges from 20 to 40 inches. The thickness of loess ranges from 10 to 20 inches. The depth to black shale bedrock ranges from 30 to 40 inches.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. It is silt loam or silty clay loam. It is extremely acid to strongly acid unless limed.

The Bt1 horizon has hue of 10YR, 7.5YR, or 5YR; value of 4 or 5; and chroma of 4 to 8. It is silt loam, silty clay loam, silty clay, or clay and is extremely acid or very strongly acid. The 2Bt horizon has colors similar to those of the Bt1 horizon. It is silty clay or clay and is extremely acid or very strongly acid.

The 2C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 to 6. It is silty clay loam, silty clay, clay, or the shaly or very shaly analogs of these textures.

Wirt Series

The Wirt series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in silty and loamy, medium acid to neutral alluvium derived from soils that formed in glacial drift. Slopes range from 0 to 2 percent.

Wirt soils are similar to Haymond soils and generally are adjacent to Caneyville, Grayford, and Negley soils. Haymond soils have less sand and more silt in the subsoil than the Wirt soils. Caneyville soils formed in limestone bedrock residuum and are moderately deep. They are on back slopes in the uplands. Grayford soils formed in loess, in glacial drift, and in the underlying limestone bedrock residuum and have more clay in the upper part of the solum than the Wirt soils. They are on summits, shoulder slopes, and back slopes in the uplands. Negley soils formed in loess and the underlying drift or outwash on valley trains and have more clay than the Wirt soils.

Typical pedon of Wirt silt loam, occasionally flooded, in a pasture; 30 feet south and 600 feet west of the northeast corner of sec. 24, T. 3 N., R. 8 E.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure in the upper part, weak thin platy in the

lower part; friable; neutral; many fine roots; clear smooth boundary.

Bw1—8 to 15 inches; dark brown (10YR 4/3) silt loam; common fine distinct light yellowish brown (10YR 6/4) mottles; weak medium subangular blocky structure; friable; common fine roots; patchy dark brown (10YR 3/3) coatings on faces of peds; neutral; gradual smooth boundary.

Bw2—15 to 22 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable; few fine roots; discontinuous dark brown (10YR 3/3) coatings on faces of peds; neutral; gradual wavy boundary.

Bw3—22 to 38 inches; dark yellowish brown (10YR 4/6) loam; few fine distinct light yellowish brown (10YR 6/4) mottles; moderate medium subangular blocky structure; friable; discontinuous dark brown (10YR 3/3) coatings on faces of peds; neutral; gradual wavy boundary.

C1—38 to 50 inches; dark yellowish brown (10YR 4/6) sandy loam; common fine distinct pale brown (10YR 6/3) mottles; massive; friable; neutral; gradual wavy boundary.

C2—50 to 60 inches; dark yellowish brown (10YR 4/4) cherty sandy loam; massive; friable; about 30 percent chert fragments 3/4 inch to 3 inches in diameter; slightly acid.

The solum ranges from 24 to 40 inches in thickness. It is medium acid to neutral. The content of coarse fragments is 0 to 15 percent in the upper 40 inches and 10 to 35 percent below a depth of 40 inches.

The Ap horizon has value of 3 to 5 and chroma of 2 to 4. It is silt loam or loam. The Bw horizon has value of 3 to 5 and chroma of 3 to 6. It is loam, silt loam, sandy loam, fine sandy loam, or very fine sandy loam.

The C1 and C2 horizons have value of 3 to 5 and chroma of 3 to 6. The C1 horizon is loam, fine sandy loam, or sandy loam. The C2 horizon is the gravelly, channery, or cherty analogs of these textures. Some pedons do not have a C2 horizon.

Formation of the Soils

In this section the major factors of soil formation and their degree of importance in the formation of the soils in the county are described. The processes of soil formation also are described.

Factors of Soil Formation

Soil forms through processes that act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil. Some time is always needed for the differentiation of soil horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effects of any one factor unless conditions are specified for the other four.

Parent Material

Dr. Stanley M. Totten, professor of geology, Hanover College, helped prepare this section.

The soils in Jefferson County formed in widely diverse parent materials. Some formed in unconsolidated sand, silt, and clay deposited by glaciers, streams, and the wind (fig. 17). Some formed in material weathered from limestone, dolomite, and shale bedrock (fig. 18). Also, the soils formed on many different kinds of landforms. The relationships among parent materials, slope, and soil morphology are close. In Jefferson County the upper part of many of the soils formed in a different kind of material than that of the lower part. The surficial material, primarily glacial drift and loess, generally is only a few feet thick. Thus, bedrock is sufficiently close to the surface to have a strong influence on soil formation.

The bedrock exposed in Jefferson County belongs to the Ordovician, Silurian, and Devonian Systems of the Paleozoic Era (fig. 18). These rocks probably were deposited about 450 to 350 million years ago as fine grained sediments in shallow marine waters. The strata dip 20 to 25 feet per mile to the west. The rock units are successively younger in that direction. Ordovician rocks are in the hilly Dearborn Upland physiographic province in the eastern part of the county and along the lower slopes of the Ohio Valley. Silurian rocks are in a north-south trending belt in the center of the county, and Devonian rocks are in the western part of the county. The western two-thirds of the county, underlain by Silurian and Devonian rocks, is characterized by a gentle westward slope known as the Muscatatuck Regional Slope.

The Kope and Dillsboro Formations (fig. 19) of the Ordovician System consist of gray, calcareous shale and thin fossiliferous limestone interbeds. Pate soils formed in material weathered from the Kope Formation on foot slopes. Eden, Carmel, Switzerland, and Nicholson soils formed partly or entirely in material weathered from the more calcareous Dillsboro Formation on summits, shoulder slopes, and back slopes. These slopes are easily eroded in the valleys of the Ohio River and Indian-Kentuck Creek and their tributaries.

The Saluda Dolomite is a ledge-former and forms the upper back slopes, which are the steepest slopes in the county. These include the cap rock in the numerous waterfalls (fig. 20), such as Clifty Falls in Clifty Falls State Park, that characterize the tributaries of the Ohio River. A shallow soil formed on these steep slopes.

The Brassfield Formation ranges from 0 to 6 feet in thickness throughout the county. The average thickness is about 2 feet. Beasley and Carmel soils formed in areas where the formation is sufficiently thick.

The Osgood Member of the Salamonie Formation consists predominantly of shale and dolomite interbeds. It forms a slope between the ledge-forming Laurel and Saluda Dolomites. Switzerland and Crider Variant soils formed partly or entirely in material weathered from soft shale on summits, shoulder slopes, and back slopes. Crider Variant soils formed partly in material weathered from the more resistant dolomite beds on summits and shoulder slopes.

The Laurel Dolomite caps the uplands throughout much of the eastern and central parts of the county. The

Geologic Series	Stage	Description	Range in Thickness (feet)	Soil Series
Holocene	Recent	organic-rich silty alluvium	0-15	Huntington
		Silty and loamy alluvium	0-5	Wirt Holton
		Channery and flaggy alluvium	0-5	Dearborn
		Silty or loamy alluvium	0-10	Elkinsville Pekin Haymond Rahm
Pleistocene	Wisconsin	Loess Silty or loamy alluvium on Ohio River terraces	0-4 0-100	Elkinsville
		Lacustrine sediments	0-30	Markland
	Illinoian	Glacial drift	0-25	Cincinnati * Rossmoyne* Avonburg * Cobbsfork* Hickory Bonnell Jennings
		Glacial drift or terrace outwash	0-10	Negley
	Pre-Illinoian	Paleosol on red drift and terra rossa residuum (in place or reworked)	0-10	Ryker* Grayford*

Figure 17.—Relationship of some soils to unconsolidated parent materials deposited by water, ice, and wind. An asterisk indicates that the soils formed partly in loess.

residuum of this dolomite is rich in chert nodules, which are abundant in the subsoil of the soils that formed in this material. The dolomite generally is covered by a thin layer of glacial drift and loess. Some soils formed in the loess and drift and in the underlying dolomite residuum. Examples are Grayford soils. Ryker soils formed in the loess and glacial drift. Reworked residuum is generally below a depth of 80 inches. Grayford and Ryker soils are on summits, shoulder slopes, and back slopes. Caneyville soils formed in the dolomite residuum on back slopes. Crider Variant soils formed in loess and in the underlying residuum. They are on summits and shoulder slopes.

The soft, easily weathered Waldron Shale forms a gentle or moderate slope between the more resistant Laurel and Louisville Formations. Switzerland and

System	Formation	Member	Average Thickness (feet)	Description	Soil Series
DEVONIAN	New Albany	Morgan Trail	35	Hard, brittle black shale	Trappist Jennings
		Selmier	5	Soft, greenish gray shale	Deputy
		Blocher	10	Soft black shale	
	North Vernon		10	Soluble bluish-gray limestone	Caneyville
	Jeffersonville		25	Grayish brown limestone	Grayford*
	Geneva		20	Brown dolomitic limestone	Ryker*
SILURIAN	Louisville		30	Tan dolomitic limestone	Crider Variant
	Waldron		8	Soft gray shale	Switzerland Nicholson
	Salamonie	Laurel	45	Gray, cherty dolomitic limestone	Caneyville Grayford* Ryker* Crider Variant
		Osgood	20	Soft gray shale dolomite interbeds	Switzerland Crider Variant
	Brassfield		2	Pink limestone, shale, siltstone	Beasley Carmel
ORDOVICIAN	Saluda		60	Massive gray to tan dolomite	A shallow inclusion in Eden, Caneyville
	Dillsboro		300	Soft gray shale: 30% thin fossiliferous limestone interbeds	Eden Carmel Switzerland Nicholson
	Kope		20	Soft gray shale: 10% thin fossiliferous limestone interbeds	Pate

Figure 18.—Relationship of some soils to the underlying consolidated bedrock. An asterisk indicates that the soils formed partly in surficial sediments (loess and glacial drift).

Nicholson soils formed partly in material weathered from the Waldron Formation on shoulder slopes.

The Louisville, Geneva, Jeffersonville, and North Vernon Formations are similar to each other. They consist of varying amounts of dolomitic, argillaceous limestone. They underlie many of the rolling uplands and gentle slopes in the western half of the county. Glacial drift and loess of variable thickness overlie the rock

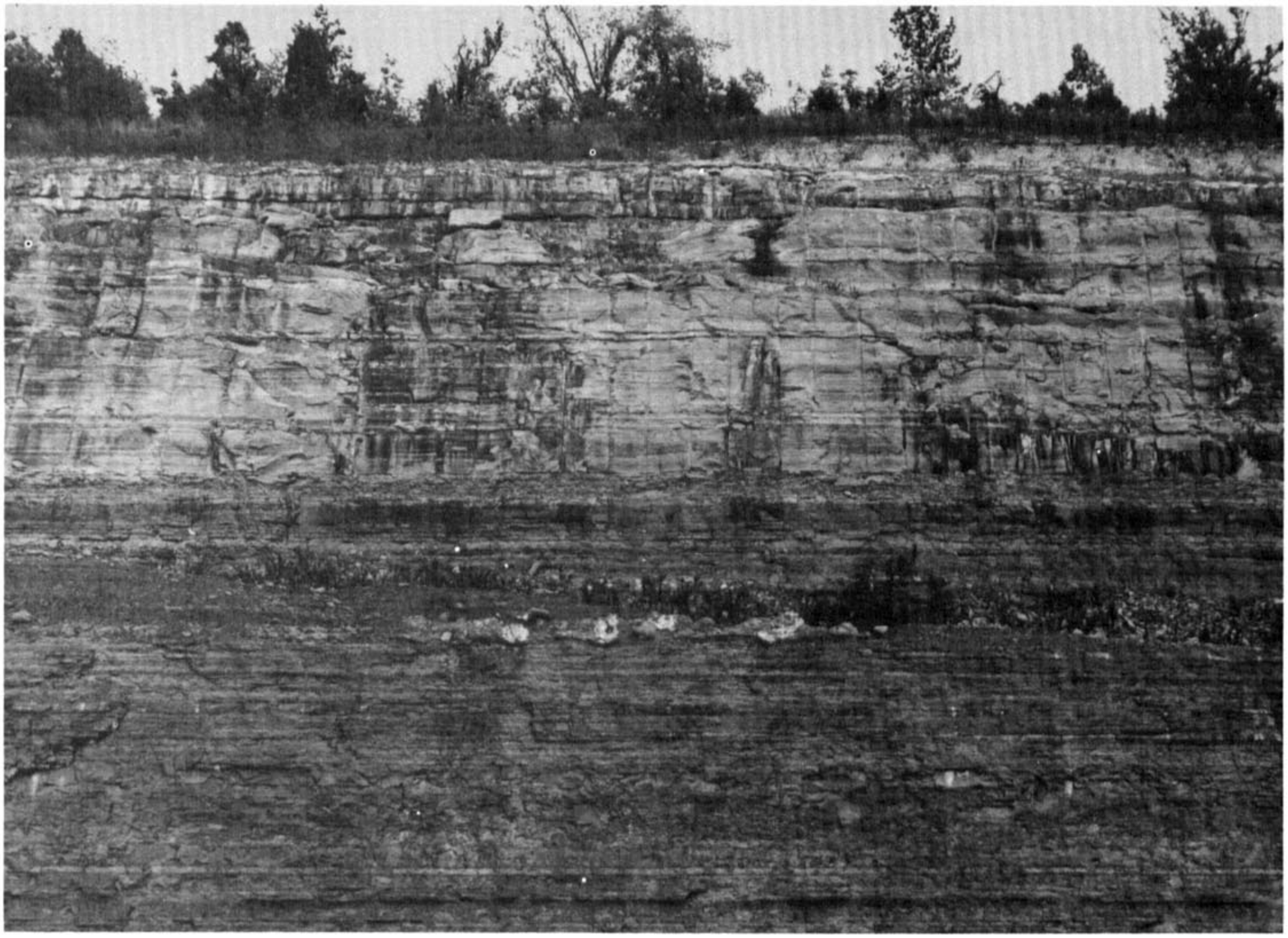


Figure 19.—Saluda Dolomite overlying interbedded, fossiliferous, calcareous shale and limestone of the Dillsboro Formation.

units. The North Vernon Limestone, which is primarily in the valleys of Big Creek and its tributaries, is quite soluble, and numerous sinkholes, or natural depressions, are on summits, shoulder slopes, and back slopes along the valleys. Caneyville, Grayford, Ryker, and Crider Variant soils formed in various combinations of drift, loess, and material weathered from these limestones and dolomites.

The New Albany Shale, the youngest rock in the county, is rich in carbonaceous matter, iron, sulfur, and trace elements but is low in content of calcium and magnesium. It is at the higher elevations throughout the western one-third of the county. In most areas it is covered by glacial drift and loess. The basal, black Blocher Member and the greenish gray Selmier Member are relatively soft and are easily weathered. The Deputy soils on summits, shoulder slopes, and back slopes formed partly in material weathered from these shales. The overlying Morgan Trail Member, a black, hard, brittle pyritic shale, is not so easily weathered as the lower members. The Trappist and Jennings soils on summits, shoulder slopes, and back slopes formed partly in material weathered from the Morgan Trail Member.

A period of weathering and erosion lasting about 350 million years followed the deposition of the limestone, dolomite, and shale bedrock. Before the beginning of glaciation about one million years ago, a red, clayey material generally known as "terra rossa" and made up primarily of clay, iron oxide, and chert formed on some of the upland surface. Remnants of this ancient soil that

developed in pre-Illinoian time are preserved beneath glacial drift and are incorporated in the basal drift under some of the upland soils. Jefferson County was covered by continental ice sheets several times during Illinoian and pre-Illinoian stages. These glaciers diverted the drainage of southeastern Indiana across the divide at Madison, thereby forming the Ohio River. They left deposits of glacial drift and outwash, and the deposits of

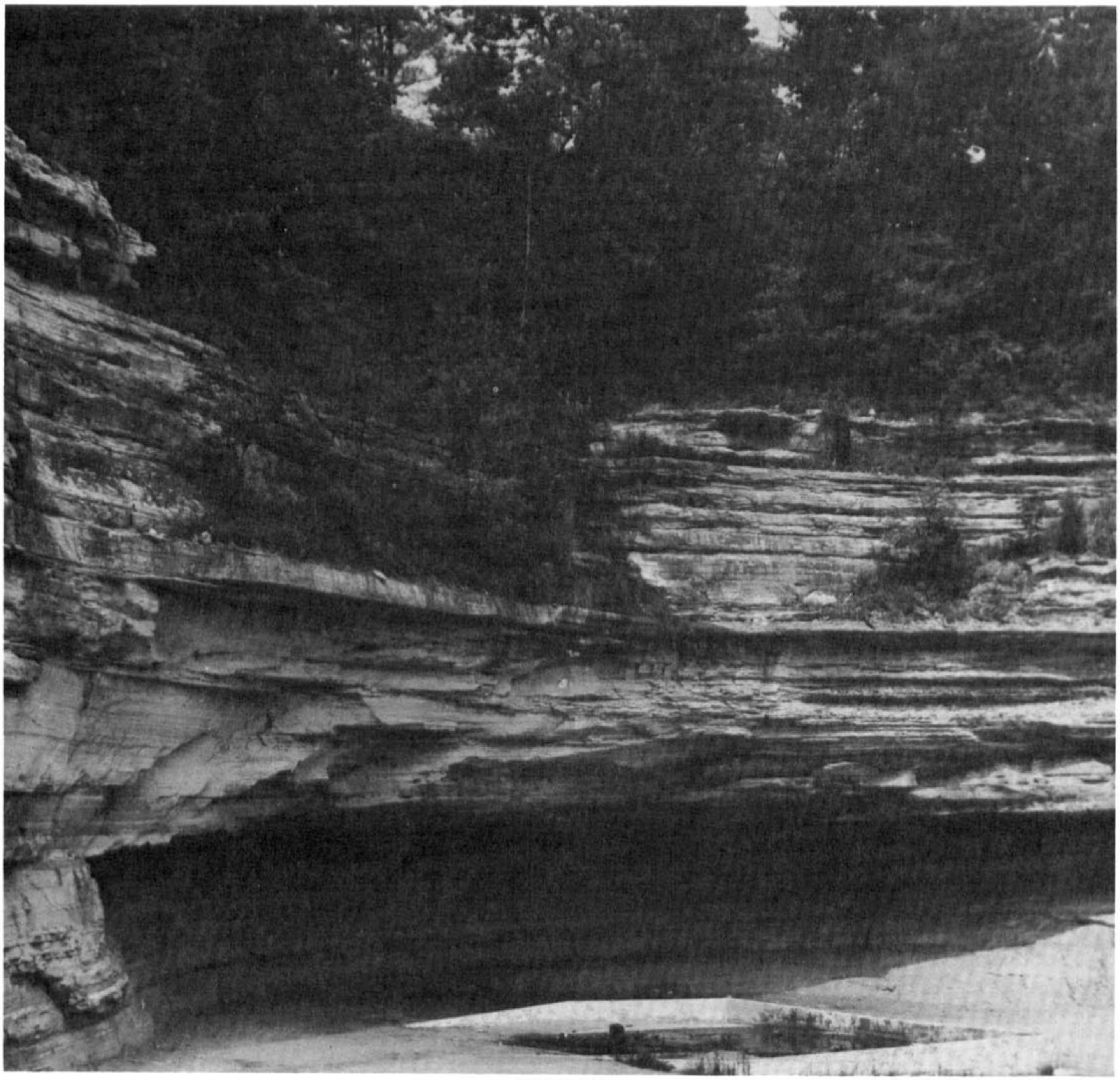


Figure 20.—Cap rock of Saluda Dolomite in a waterfall.

lacustrine material and alluvium were laid down at a later date. In places a red, loamy deposit less than 10 feet thick overlies the "terra rossa" material. This may be an old till, a reworked till, or a transported sediment derived from the ancient soil that formed in pre-Illinoian time *(3)*. Ryker soils formed in loess and the red, loamy deposit and generally have "terra rossa" below a depth of 7 feet, whereas Grayford soils formed in loess, the red, loamy deposit, and the underlying "terra rossa." Both soils are on summits, shoulder slopes, and back slopes.

Illinoian drift, ranging in thickness from a few feet near the Ohio River to 30 feet or more in places in the western part of the county, is the parent material of many upland soils. About 2 to 4 feet of Wisconsin-age Peorian loess, which is windblown silt derived primarily from the flood plains along the Ohio River and other major rivers, mantles the drift. The lower part of the loess has relatively more sand than the upper part and probably was derived from local sources during the retreat of Illinoian ice. The upper part is silty and may have been derived from more distant sources during the Wisconsin period. Both loess deposits contain an appreciable amount of clay. A fragipan has formed at the boundary between the two loesses in many areas where the underlying bedrock is relatively impermeable. The drift and loess together are the parent material of Cincinnati, Rossmoyne, Avonburg, Cobbsfork, Bonnell, and Hickory soils. Avonburg and Cobbsfork soils are on tabular divides. Cincinnati, Rossmoyne, Bonnell, and Hickory soils are on summits, shoulder slopes, and back slopes. The Illinoian drift and loess formerly were the surface material throughout the county, but erosion has removed nearly all drift and loess from the valley bottoms and from the hillsides in the eastern part of the county.

Melting of Illinoian ice resulted in the deposition of outwash along Big Creek in the northwestern part of the county. Negley soils formed partly in this red material.

The Wisconsin ice advance did not reach as far south as Jefferson County, but melt water from this last ice advance deposited large volumes of sand and gravel outwash in the valley of the Ohio River. The terrace gravel underlies silty or loamy alluvium, which is the parent material of Elkinsville and Pekin soils. Deposition of the terrace gravel in the valley of the Ohio River raised the terrace level above the level of the tributaries of the river, thereby damming the tributary streams and forming temporary lakes. The resulting lacustrine sediments, which are preserved in a terrace in the valley of Indian-Kentuck Creek, are the parent material of Markland soils.

After the last of the ice sheets melted, about 20,000 years ago, rivers and streams modified the landscape slightly, causing the development of new flood plains. These modern flood plains have alluvial deposits of clay, silt, sand, gravel, and cobbles. The silty and loamy alluvium along Big Creek is the parent material of Wirt and Holton soils. Haymond soils formed in silty alluvium, mainly along the Muscatatuck River. Huntington soils formed in the organic-rich, silty alluvium on the flood plains along the Ohio River and Indian-Kentuck Creek. Dearborn soils formed in the channery and flaggy alluvium that collects in the narrow valleys and on toe slopes at the base of steep hillsides in the eastern part of the county. Elkinsville, Pekin, and Rahm soils formed in alluvium that is older than the alluvium on modern flood plains. Elkinsville and Pekin soils are on terraces along most of the larger streams. Rahm soils are on flood plains and low stream terraces near the mouth of Indian-Kentuck Creek.

Plant and Animal Life

Plants have been the principal living organism influencing the soils in Jefferson County. Bacteria, fungi, earthworms, and human activities, however, also have been important. The chief contribution of plant and animal life is the addition of organic matter and nitrogen to the soil. The kind of organic material on and in the soil depends on the kind of native plants that grew on the soil. The remains of these plants accumulate in the surface layer, decay, and eventually become organic matter. The roots provide channels for the downward movement of water through the soil and add organic matter as they decay. Bacteria in the soil help to break down the organic matter so that it can be used by growing plants.

The native vegetation in Jefferson County was mainly deciduous trees. Differences in natural soil drainage and minor variations in the parent material have affected the composition of the forest species. The well drained upland soils, such as Eden and Cincinnati, were covered mainly by sugar maple, hickory, white oak, and red oak. The wet soils, such as Cobbsfork and Avonburg, were covered primarily by beech, sweetgum, blackgum, and pin oak.

Climate

Climate is important in the formation of soils. It determines the kind of plant and animal life on and in the soil and the amount of water available for the weathering of minerals and the transfer of soil material. Through its influence on soil temperature, it also determines the rate of chemical reaction in the soil. These influences are important, but they affect large areas rather than a relatively small area, such as a county.

The climate in Jefferson County is cool and humid. It is presumably similar to that under which the soils formed. The soils in the county differ from the soils that formed under a dry, warm climate and from those that formed under a hot, moist climate. The climate is uniform throughout the county, although its effect is modified locally by runoff, direction of slope, steepness of slope,

and proximity to the Ohio River. Differences among the soils in the county are, to a minor extent, the result of these local differences. More detailed information about the climate is available under the heading "General Nature of the County."

Relief

Relief has a marked influence on the soils of Jefferson County through its effect on natural drainage, erosion, plant cover, and soil temperature. Slopes in the county range from 0 to 60 percent. Natural soil drainage ranges from well drained on the hillsides to poorly drained on the broad, nearly level divides.

Through its effect on drainage, relief affects aeration in the soil. Aeration, in turn, largely determines the color of the soil. Surface runoff is most rapid on the steeper slopes and is slow on the broad, nearly level ridges. Water and air move freely through well drained soils but slowly through poorly drained soils. In well aerated soils, the iron compounds that give most soils their color are brightly colored and oxidized, whereas in poorly aerated soils the color is dull gray and mottled. Ryker soils are an example of well drained, well aerated soils, and Cobbsfork soils are an example of poorly aerated, poorly drained soils.

Time

Time, usually a long time, is needed for the agents of soil formation to create distinct horizons in the soil. Differences in the length of time that the parent materials have been in place are commonly reflected in the degree of profile development. Some soils form rapidly; others, slowly.

The soils in Jefferson County range from young to mature. The glacial deposits in which many of the soils formed have been exposed to soil-forming factors for a long enough time to allow distinct horizons to develop within the profile. Some soils that formed in recent alluvial sediments, however, have not been in place long enough for distinct horizons to develop. Haymond soils are an example of these young soils.

Markland and Cincinnati soils show the effect of time on the leaching of lime. The substratum of these soils has about the same amount of lime as the parent material of the solum had before the soils formed. Markland soils were submerged under glacial lake water and were not subject to leaching. In contrast, Cincinnati soils were above water and were subject to leaching. They are leached of lime to a depth of more than 10 feet. On the other hand, Markland soils are calcareous at a depth of about 29 inches.

Processes of Soil Formation

Several processes have been involved in the formation of the soils in the county. These processes are the accumulation of organic matter; the solution, transfer, and removal of calcium carbonates and bases; the liberation and translocation of silicate clay minerals; and the reduction and transfer of iron. In most soils more than one of these processes has been active in horizon differentiation.

Some organic matter has accumulated in the surface layer of all the soils in the county. Organic matter content is low in some soils and high in others. Generally, the soils that have the most organic matter, such as Dearborn or Huntington soils, have a thick, dark surface horizon.

Carbonates and bases have been leached from the upper horizons of nearly all the soils in the county. Leaching is generally believed to precede the translocation of silicate clay minerals. Nearly all of the carbonates and some of the bases have been leached from the A and B horizons of well drained soils. Even in the wettest soils, some leaching is indicated by the absence of carbonates and by an acid reaction. Leaching in wet soils is slow because of a seasonal high water table or because water moves slowly through these soils.

Clay accumulates in pores and other voids in the soils and forms clay films on the surfaces along which water moves. Leaching of bases and translocation of silicate clays are among the more important processes in horizon differentiation in the soils. Switzerland soils are an example of soils in which translocated silicate clays have accumulated as clay films in the 2Bt horizon.

The reduction and transfer of iron, or gleying, has occurred in all of the poorly drained and somewhat poorly drained soils in the county. In the naturally wet soils, this process has been significant in horizon differentiation. The reduction is commonly accompanied by some transfer of iron, either from upper horizons to lower horizons or completely out of the profile. Mottles, which are in some horizons, indicate the segregation of iron. The gray color of the subsoil indicates the presence of reduced iron compounds or the loss of iron from the horizon.

References

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vols., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) Bryant, R. B. Genesis of the Ryker and associated soils in southern Indiana. Ph.D. thesis, 217 pp., illus. [Abstracted in Dissertation Abstracts International 42: 4266]

(4) Howard, Needles, Tammen, and Bergendoff. 1979. Comprehensive master plan, City of Madison, Indiana. Vol. 1, illus.

(5) Indiana Conservation Needs Committee. 1967. ADP summary of CN data of Jefferson County, Indiana. [Loose printouts]

(6) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus.

(7) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

(8) United States Department of Commerce, Bureau of the Census. 1983. 1982 census of agriculture, preliminary report, Jefferson County, Indiana. [Loose printouts]

(9) Vogt, Sage, and Pflum, consultants. 1973. Comprehensive plan report, Jefferson County, Indiana. 90 pp., illus.

Glossary

ABC soil. A soil having an A, a B, and a C horizon.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, subsurface. Removal of excess ground water through buried drains installed within the soil profile. The drains collect the water and convey it to a gravity or pump outlet.

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial melt water. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:
O horizon.—An organic layer of fresh and decaying plant residue.
A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.
E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.
B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C

horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the

material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Data were recorded in the period 1951-76 at Madison, Indiana]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F		In	In	In		In
January----	42.0	24.0	33.1	67	-3	33	3.21	1.80	4.36	7	5.4
February---	46.7	26.7	36.7	69	1	74	3.34	1.52	4.82	7	2.3
March------	55.4	33.7	44.5	80	14	231	4.48	2.48	6.10	9	2.9
April------	68.4	43.5	55.8	86	25	474	4.03	2.02	5.66	9	.1
May--------	77.5	52.8	65.2	93	33	781	4.48	2.59	6.01	8	.0
June-------	85.3	62.2	73.8	97	45	1,014	4.01	2.36	5.46	7	.0
July-------	88.1	65.9	77.0	98	51	1,147	3.76	2.18	5.03	7	.0
August-----	87.3	64.2	75.8	98	50	1,110	2.61	1.18	3.78	5	.0
September--	82.3	57.9	70.1	97	40	903	3.15	1.49	4.49	6	.0
October----	71.4	46.5	59.0	88	27	589	2.60	1.27	3.68	5	.0
November---	56.3	36.5	46.4	79	14	216	3.25	1.78	4.44	6	.6
December---	44.7	26.8	35.7	70	2	75	3.05	1.54	4.29	6	1.8
Yearly:											
Average--	67.1	45.1	56.1	---	---	---	---	---	---	---	---
Extreme--	---	---	---	102	-5	---	---	---	---	---	---
Total----	---	---	---	---	---	6,647	41.97	35.46	48.16	82	13.1

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Data were recorded in the period 1951-76 at Madison, Indiana]

Probability	Temperature: 24° F or lower	Temperature: 28° F or lower	Temperature: 32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 7	April 18	April 30
2 years in 10 later than--	April 2	April 14	April 25
5 years in 10 later than--	March 23	April 5	April 16
First freezing temperature in fall:			
1 year in 10 earlier than--	November 1	October 21	October 7
2 years in 10 earlier than--	November 6	October 26	October 12
5 years in 10 earlier than--	November 17	November 4	October 23

TABLE 3.--GROWING SEASON

[Data were recorded in the period 1951-76 at Madison, Indiana]

Probability	Daily minimum temperature during growing season: Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	220	192	172
8 years in 10	226	199	178
5 years in 10	239	213	189
2 years in 10	252	227	201
1 year in 10	258	234	207

TABLE 4.--SUITABILITIES AND LIMITATIONS OF MAP UNITS ON THE GENERAL SOIL MAP

Map unit	Extent of area	Cultivated crops	Specialty crops	Woodland	Urban uses	Intensive recreation areas	Extensive recreation areas
	Pct						
1. Wirt-Haymond	2	Good	Poor: flooding.	Good	Poor: flooding.	Fair: flooding.	Good.
2. Huntington-Dearborn-Elkinsville	4	Good	Fair: flooding.	Good	Poor: flooding.	Good	Good.
3. Cobbsfork-Avonburg	32	Good	Poor: wetness.	Fair: wetness.	Poor: wetness.	Poor: wetness.	Fair: wetness.
4. Cincinnati-Rossmoyne-Hickory	28	Good	Fair: slope.	Good	Good	Fair: slow permeability, slope.	Good.
5. Eden-Carmel	25	Poor: slope.	Poor: slope.	Good	Poor: slope.	Poor: slope.	Good.
6. Ryker-Grayford	9	Good	Good	Good	Good	Good	Good.

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AvA	Avonburg silt loam, 0 to 2 percent slopes	22,286	9.5
AvB2	Avonburg silt loam, 2 to 4 percent slopes, eroded	3,436	1.5
BeD3	Beasley-Rock outcrop complex, 12 to 25 percent slopes, severely eroded	4,763	2.0
BnC2	Bonnell silt loam, 6 to 12 percent slopes, eroded	1,413	0.6
BnC3	Bonnell silt loam, 6 to 12 percent slopes, severely eroded	208	0.1
BnD2	Bonnell silt loam, 12 to 18 percent slopes, eroded	929	0.4
BnD3	Bonnell silt loam, 12 to 18 percent slopes, severely eroded	780	0.3
BnE	Bonnell silt loam, 18 to 45 percent slopes	1,295	0.6
CaF	Caneyville-Rock outcrop complex, 25 to 60 percent slopes	3,597	1.5
CcC2	Carmel silt loam, 6 to 12 percent slopes, eroded	6,347	2.7
CdC3	Carmel silty clay loam, 6 to 12 percent slopes, severely eroded	791	0.3
CnB2	Cincinnati silt loam, 2 to 6 percent slopes, eroded	15,346	6.6
CnC2	Cincinnati silt loam, 6 to 12 percent slopes, eroded	9,867	4.2
CnC3	Cincinnati silt loam, 6 to 12 percent slopes, severely eroded	2,971	1.3
Co	Cobbsfork silt loam	34,347	14.7
CrB2	Crider Variant silt loam, 2 to 6 percent slopes, eroded	318	0.1
Da	Dearborn silt loam, frequently flooded	853	0.4
Db	Dearborn channery silt loam, frequently flooded	2,401	1.0
DeB2	Deputy silt loam, 2 to 6 percent slopes, eroded	1,573	0.7
DeC2	Deputy silt loam, 6 to 12 percent slopes, eroded	1,140	0.5
DeC3	Deputy silt loam, 6 to 12 percent slopes, severely eroded	267	0.1
Du	Dumps	256	0.1
EeD2	Eden silty clay loam, 12 to 25 percent slopes, eroded	8,669	3.7
EfF	Eden flaggy silty clay loam, 25 to 50 percent slopes	24,284	10.4
EgG	Eden-Caneyville complex, 25 to 60 percent slopes	6,475	2.8
EkA	Elkinsville silt loam, 0 to 2 percent slopes, rarely flooded	757	0.3
EkB	Elkinsville silt loam, 2 to 8 percent slopes, rarely flooded	1,919	0.8
GrC2	Grayford silt loam, 6 to 12 percent slopes, eroded	1,414	0.6
GrC3	Grayford silt loam, 6 to 12 percent slopes, severely eroded	316	0.1
GrD2	Grayford silt loam, 12 to 18 percent slopes, eroded	3,258	1.4
GrD3	Grayford silt loam, 12 to 18 percent slopes, severely eroded	1,098	0.5
Ha	Haymond silt loam, occasionally flooded	969	0.4
HkC2	Hickory silt loam, 6 to 12 percent slopes, eroded	1,199	0.5
HkC3	Hickory silt loam, 6 to 12 percent slopes, severely eroded	456	0.2
HkD2	Hickory silt loam, 12 to 18 percent slopes, eroded	2,942	1.3
HkD3	Hickory silt loam, 12 to 18 percent slopes, severely eroded	1,720	0.7
HkE	Hickory silt loam, 18 to 45 percent slopes	3,220	1.4
Ho	Holton loam, occasionally flooded	3,660	1.6
Hu	Huntington silt loam, occasionally flooded	2,664	1.1
JnB2	Jennings silt loam, 2 to 6 percent slopes, eroded	1,368	0.6
JnC2	Jennings silt loam, 6 to 12 percent slopes, eroded	1,257	0.5
JnC3	Jennings silt loam, 6 to 12 percent slopes, severely eroded	618	0.3
MaB2	Markland silt loam, 1 to 6 percent slopes, eroded	293	0.1
MaC2	Markland silt loam, 8 to 15 percent slopes, eroded	180	0.1
NeB2	Negley silt loam, 2 to 6 percent slopes, eroded	183	0.1
NeC2	Negley silt loam, 6 to 12 percent slopes, eroded	432	0.2
NnB2	Nicholson silt loam, 2 to 6 percent slopes, eroded	2,184	0.9
PeE	Pate silty clay loam, 18 to 35 percent slopes	310	0.1
PkB	Pekin silt loam, 1 to 4 percent slopes, rarely flooded	1,170	0.5
Pu	Pits, quarries	100	*
Ra	Rahm silty clay loam, occasionally flooded	450	0.2
RoA	Rossmoyne silt loam, 0 to 2 percent slopes	9,387	4.0
RoB2	Rossmoyne silt loam, 2 to 6 percent slopes, eroded	10,730	4.6
RyA	Ryker silt loam, 0 to 2 percent slopes	1,168	0.5
RyB2	Ryker silt loam, 2 to 6 percent slopes, eroded	5,026	2.1
RyC2	Ryker silt loam, 6 to 12 percent slopes, eroded	4,752	2.0
RyC3	Ryker silt loam, 6 to 12 percent slopes, severely eroded	847	0.4
SwB2	Switzerland silt loam, 2 to 6 percent slopes, eroded	861	0.4
SxC2	Switzerland-Carmel silt loams, 2 to 12 percent slopes, eroded	1,407	0.6
TrC2	Trappist silt loam, 6 to 12 percent slopes, eroded	333	0.1
TrD2	Trappist silt loam, 12 to 18 percent slopes, eroded	697	0.3
TtC3	Trappist silty clay loam, 6 to 12 percent slopes, severely eroded	844	0.4
TtD3	Trappist silty clay loam, 12 to 25 percent slopes, severely eroded	652	0.3
Ud	Udorthents, loamy	632	0.3
Wt	Wirt silt loam, occasionally flooded	7,780	3.3
	Water greater than 40 acres in size	75	*
	Water less than 40 acres in size	300	0.1
	Total	234,240	100.0

* Less than 0.1 percent.

TABLE 6.--PRIME FARMLAND

[Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name]

Map symbol	Soil name
AvA	Avonburg silt loam, 0 to 2 percent slopes (where drained)
AvB2	Avonburg silt loam, 2 to 4 percent slopes, eroded (where drained)
CnB2	Cincinnati silt loam, 2 to 6 percent slopes, eroded
Co	Cobbsfork silt loam (where drained)
CrB2	Crider Variant silt loam, 2 to 6 percent slopes, eroded
DeB2	Deputy silt loam, 2 to 6 percent slopes, eroded
EkA	Elkinsville silt loam, 0 to 2 percent slopes, rarely flooded
EkB	Elkinsville silt loam, 2 to 8 percent slopes, rarely flooded
Ha	Haymond silt loam, occasionally flooded
Ho	Holton loam, occasionally flooded (where drained)
Hu	Huntington silt loam, occasionally flooded
JnB2	Jennings silt loam, 2 to 6 percent slopes, eroded
MaB2	Markland silt loam, 1 to 6 percent slopes, eroded
NeB2	Negley silt loam, 2 to 6 percent slopes, eroded
NnB2	Nicholson silt loam, 2 to 6 percent slopes, eroded
PkB	Pekin silt loam, 1 to 4 percent slopes, rarely flooded
Ra	Rahm silty clay loam, occasionally flooded (where drained)
RoA	Rossmoyne silt loam, 0 to 2 percent slopes
RoB2	Rossmoyne silt loam, 2 to 6 percent slopes, eroded
RyA	Ryker silt loam, 0 to 2 percent slopes
RyB2	Ryker silt loam, 2 to 6 percent slopes, eroded
SwB2	Switzerland silt loam, 2 to 6 percent slopes, eroded
Wt	Wirt silt loam, occasionally flooded

TABLE 7.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Orchardgrass-red clover hay	Tall fescue
		Bu	Bu	Bu	Tons	AUM*
AvA: Avonburg	IIw	110	38	50	3.6	7.2
AvB2: Avonburg	IIe	100	35	45	3.3	6.6
BeD3: Beasley-Rock outcrop	VIe	---	---	---	---	3.0
BnC2: Bonnell	IIIe	90	27	32	3.4	7.0
BnC3: Bonnell	IVe	85	25	30	3.3	6.6
BnD2: Bonnell	IVe	80	---	28	2.7	5.4
BnD3: Bonnell	VIe	---	---	---	2.5	5.0
BnE: Bonnell	VIe	---	---	---	---	---
CaF: Caneyville-Rock outcrop	VIIe	---	---	---	---	---
CcC2: Carmel	IIIe	90	28	36	2.6	5.2
CdC3: Carmel	IVe	80	24	32	2.3	4.6
CnB2: Cincinnati	IIe	105	30	45	4.5	9.0
CnC2: Cincinnati	IIIe	100	30	40	4.5	9.0
CnC3: Cincinnati	IVe	90	20	35	4.0	8.0
Co: Cobbsfork	IIIw	110	35	35	3.6	7.2
CrB2: Crider Variant	IIe	115	40	46	3.8	7.6
Da: Dearborn	IIIs	90	38	40	3.0	6.0
Db: Dearborn	IIIs	70	25	30	2.8	5.6
DeB2: Deputy	IIe	102	---	40	3.7	7.4
DeC2: Deputy	IIIe	95	---	30	3.7	7.4
DeC3: Deputy	IVe	90	---	30	3.5	7.0

See footnotes at end of table.

TABLE 7.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Orchardgrass-red clover hay	Tall fescue
		Bu	Bu	Bu	Tons	AUM*
Du**. Dumps						
EeD2 Eden	IVe	70	20	---	2.5	5.0
EfF Eden	VIIe	---	---	---	---	---
EgG Eden-Caneyville	VIIe	---	---	---	---	---
EkA Elkinsville	I	120	42	48	4.0	8.0
EkB Elkinsville	IIe	120	42	48	4.0	8.0
GrC2 Grayford	IIIe	100	36	41	3.3	6.6
GrC3 Grayford	IVe	95	30	37	3.0	6.0
GrD2 Grayford	IVe	95	30	35	2.8	5.6
GrD3 Grayford	VIe	---	---	34	2.8	5.6
Ha Haymond	IIw	110	39	42	3.7	8.0
HkC2 Hickory	IIIe	78	25	28	2.9	5.0
HkC3 Hickory	IVe	70	23	25	2.6	4.5
HkD2 Hickory	IVe	67	---	26	2.5	4.5
HkD3 Hickory	VIe	---	---	---	2.3	4.0
HkE Hickory	VIe	---	---	---	---	---
Ho Holton	IIw	80	30	45	4.0	6.4
Hu Huntington	IIw	130	45	---	3.5	6.0
JnB2 Jennings	IIe	85	30	38	2.8	5.6
JnC2 Jennings	IIIe	75	26	34	2.5	5.0
JnC3 Jennings	IVe	65	23	29	2.1	4.2
MaB2 Markland	IIIe	80	28	36	2.6	5.2

See footnotes at end of table.

TABLE 7.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Orchardgrass-red clover hay	Tall fescue
		Bu	Bu	Bu	Tons	AUM*
MaC2----------------------- Markland	IVe	70	24	32	2.3	4.6
NeB2----------------------- Negley	IIe	95	32	42	3.2	5.5
NeC2----------------------- Negley	IIIe	85	25	35	2.7	5.2
NnB2----------------------- Nicholson	IIe	120	37	---	3.5	6.5
PeE------------------------ Pate	VIIe	---	---	---	1.2	2.1
PkB------------------------ Pekin	IIe	105	37	47	3.4	6.8
Pu**----------------------- Pits	VIII	---	---	---	---	---
Ra------------------------- Rahm	IIw	135	47	54	4.4	8.8
RoA------------------------ Rossmoyne	IIw	110	35	40	4.5	8.5
RoB2----------------------- Rossmoyne	IIe	100	30	35	4.0	7.5
RyA------------------------ Ryker	I	125	44	50	4.1	8.2
RyB2----------------------- Ryker	IIe	115	40	46	3.8	7.6
RyC2----------------------- Ryker	IIIe	110	38	44	3.6	7.2
RyC3----------------------- Ryker	IVe	105	37	42	3.4	6.8
SwB2----------------------- Switzerland	IIe	90	32	40	3.0	6.0
SxC2----------------------- Switzerland-Carmel	IIIe	85	28	36	2.6	5.2
TrC2----------------------- Trappist	IIIe	70	27	---	3.3	6.0
TrD2----------------------- Trappist	IVe	60	25	---	3.0	5.0
TtC3----------------------- Trappist	IVe	65	25	---	3.0	5.0
TtD3----------------------- Trappist	VIe	---	---	---	---	4.0
Ud**. Udorthents						
Wt------------------------- Wirt	IIw	95	32	42	4.0	7.4

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	1,925	---	---	---
II	91,310	44,114	47,196	---
III	67,455	29,854	34,347	3,254
IV	28,756	28,756	---	---
V	---	---	---	---
VI	8,765	8,765	---	---
VII	34,666	34,666	---	---
VIII	100	---	---	100

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
AvA, AvB2---------- Avonburg	3d	Slight	Slight	Moderate	Moderate	White oak----------- Northern red oak---- Pin oak------------- Yellow-poplar------- Sweetgum------------	70 75 85 85 80	Eastern white pine, baldcypress, white ash, red maple, yellow-poplar, American sycamore.
BeD3*:								
Beasley-----------	4r	Moderate	Severe	Moderate	Slight	White oak----------- Scarlet oak--------- Eastern redcedar---- Chinkapin oak------- Hickory------------- White ash-----------	60 60 --- --- --- ---	White oak, Virginia pine, eastern redcedar, black oak.
Rock outcrop.								
BnC2--------------- Bonnell	2c	Slight	Moderate	Slight	Slight	Northern red oak---- Yellow-poplar------- Shortleaf pine------ Virginia pine-------	76 90 80 80	Yellow-poplar, eastern white pine, shortleaf pine, Virginia pine, loblolly pine.
BnC3--------------- Bonnell	3c	Slight	Moderate	Moderate	Slight	Northern red oak---- Shortleaf pine------ Virginia pine-------	66 70 70	Virginia pine, shortleaf pine, loblolly pine.
BnD2--------------- Bonnell	2r	Moderate	Severe	Slight	Slight	Northern red oak---- Yellow-poplar------- Shortleaf pine------ Virginia pine-------	76 90 80 80	Yellow-poplar, eastern white pine, shortleaf pine, Virginia pine, loblolly pine.
BnD3--------------- Bonnell	3r	Moderate	Severe	Moderate	Slight	Northern red oak---- Shortleaf pine------ Virginia pine-------	66 70 70	Virginia pine, shortleaf pine, loblolly pine.
BnE---------------- Bonnell	2r	Moderate	Severe	Slight	Slight	Northern red oak---- Yellow-poplar------- Shortleaf pine------ Virginia pine-------	76 90 80 80	Yellow-poplar, eastern white pine, shortleaf pine, Virginia pine, loblolly pine.
CaF*:								
Caneyville--------	2c	Severe	Severe	Slight	Slight	Yellow-poplar------- Black oak-----------	90 80	Yellow-poplar, black walnut, Virginia pine.
Rock outcrop.								
CcC2--------------- Carmel	1c	Slight	Slight	Severe	Severe	Northern red oak---- Yellow-poplar------- Virginia pine------- Shortleaf pine------ Eastern white pine-- Sweetgum------------	86 98 --- --- --- ---	Eastern white pine, yellow-poplar, black walnut, white ash, red pine.
CdC3--------------- Carmel	2c	Slight	Moderate	Severe	Severe	Northern red oak---- White oak----------- Yellow-poplar------- White ash-----------	80 --- 90 ---	Eastern white pine, red pine, Virginia pine, black walnut, yellow-poplar.
CnB2, CnC2, CnC3--- Cincinnati	2a	Slight	Slight	Slight	Slight	Northern red oak---- White oak----------- Black walnut-------- Black cherry-------- Sugar maple--------- White ash----------- Yellow-poplar-------	80 --- --- --- --- --- ---	Eastern white pine, black walnut, yellow-poplar, white ash, red pine, northern red oak, white oak.

See footnote at end of table.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
Co----------------- Cobbsfork	1w	Slight	Severe	Moderate	Moderate	Pin oak------------- Yellow-poplar------- American beech------ Red maple----------- Sweetgum------------	100 --- --- --- ---	American sycamore, eastern cottonwood, green ash, pin oak, red maple, silver maple, swamp white oak, sweetgum.
CrB2--------------- Crider Variant	1a	Slight	Slight	Slight	Slight	White oak----------- Yellow-poplar------- Sweetgum------------	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash.
Da, Db------------- Dearborn	2f	Slight	Moderate	Slight	Slight	Yellow-poplar------- Sweetgum------------ White ash-----------	90 --- ---	Black walnut, eastern cottonwood, sweetgum, yellow-poplar, white ash, eastern white pine, shortleaf pine.
DeB2, DeC2, DeC3--- Deputy	2a	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar------- Virginia pine-------	71 90 70	Eastern white pine, black walnut, yellow-poplar.
EeD2--------------- Eden	3c	Moderate	Moderate	Moderate	Moderate	Black oak----------- White oak----------- White ash----------- Scarlet oak--------- Black walnut-------- Eastern redcedar----	75 62 70 73 --- 40	Eastern redcedar, white oak, black oak, white ash, eastern white pine, eastern redcedar.
EfF---------------- Eden	3r	Severe	Severe	Moderate	Moderate	Black oak----------- White oak----------- White ash----------- Scarlet oak--------- Black walnut-------- Eastern redcedar----	75 62 70 73 --- 40	Eastern redcedar, white oak, black oak, white ash, eastern white pine, eastern redcedar.
EgG*: Eden---------------	3r	Severe	Severe	Moderate	Moderate	Black oak----------- White oak----------- White ash----------- Scarlet oak--------- Black walnut-------- Eastern redcedar----	75 62 70 73 --- 40	Eastern redcedar, white oak, black oak, white ash, eastern white pine, eastern redcedar.
Caneyville.								
EkA, EkB----------- Elkinsville	1a	Slight	Slight	Slight	Slight	White oak----------- Yellow-poplar------- Sweetgum------------	90 98 76	Eastern white pine, red pine, white ash, yellow-poplar, black walnut, black locust.
GrC2, GrC3, GrD2, GrD3-------------- Grayford	1a	Slight	Slight	Slight	Slight	White oak----------- Yellow-poplar------- Sweetgum------------	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash.
Ha----------------- Haymond	1a	Slight	Slight	Slight	Slight	Yellow-poplar------- White oak----------- Black walnut--------	100 90 70	Eastern white pine, black walnut, yellow-poplar, black locust.
HkC2, HkC3--------- Hickory	1a	Slight	Slight	Slight	Slight	White oak----------- Northern red oak---- Black oak----------- Green ash----------- Bitternut hickory--- Yellow-poplar-------	85 85 --- --- --- 95	Eastern white pine, red pine, yellow-poplar, sugar maple, white oak, black walnut.

See footnote at end of table.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
HkD2, HkD3 Hickory	1r	Moderate	Moderate	Slight	Slight	White oak	85	Eastern white pine, red pine, yellow-poplar, sugar maple, white oak, black walnut.
						Northern red oak	85	
						Black oak	---	
						Green ash	---	
						Bitternut hickory	---	
						Yellow-poplar	95	
HkE Hickory	1r	Severe	Severe	Slight	Slight	White oak	85	Eastern white pine, red pine, yellow-poplar, sugar maple, white oak, black walnut.
						Northern red oak	85	
						Black oak	---	
						Green ash	---	
						Bitternut hickory	---	
						Yellow-poplar	95	
Ho Holton	2a	Slight	Slight	Slight	Slight	Pin oak	85	Eastern white pine, yellow-poplar, black walnut, red pine, white ash, white oak.
						Northern red oak	80	
						Yellow-poplar	90	
						Sugar maple	80	
						White oak	---	
						Black walnut	---	
						Black cherry	---	
						White ash	---	
Hu Huntington	1a	Slight	Slight	Slight	Slight	Yellow-poplar	95	Yellow-poplar, black walnut, black locust, eastern white pine.
						Northern red oak	85	
JnB2, JnC2, JnC3 Jennings	3a	Slight	Slight	Slight	Slight	Northern red oak	70	Eastern white pine, red pine, northern red oak, yellow-poplar, black walnut, white oak, white ash, green ash, black cherry.
						White oak	65	
						Yellow-poplar	80	
MaB2, MaC2 Markland	2c	Slight	Slight	Severe	Severe	White oak	75	Eastern white pine, red pine, yellow-poplar, white ash.
						Northern red oak	78	
NeB2, NeC2 Negley	1a	Slight	Slight	Slight	Slight	Yellow-poplar	99	Eastern white pine, black walnut, yellow-poplar, red pine, white ash, white oak, northern red oak.
						Northern red oak	94	
						White oak	---	
						Black walnut	---	
						Black cherry	---	
						Sugar maple	---	
						White ash	---	
NnB2 Nicholson	2a	Slight	Slight	Slight	Slight	Northern red oak	80	Black oak, yellow-poplar, white oak, sweetgum, white ash.
						Black oak	76	
						White oak	71	
						Hickory	---	
						Sweetgum	---	
PeE Pate	1r	Moderate	Moderate	Severe	Severe	Northern red oak	86	Eastern white pine, yellow-poplar, black walnut, white ash, red pine.
						Yellow-poplar	98	
						Virginia pine	---	
						White oak	---	
						Sweetgum	---	
PkB Pekin	3a	Slight	Slight	Slight	Slight	White oak	70	Eastern white pine, shortleaf pine, red pine, yellow-poplar, white ash.
						Yellow-poplar	85	
						Virginia pine	75	
						Sugar maple	75	

See footnote at end of table.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
Ra----------------- Rahm	1a	Slight	Slight	Slight	Slight	Yellow-poplar-------	100	Eastern white pine, American sycamore, yellow-poplar, white oak, northern red oak, white ash, green ash, eastern cottonwood.
RoA, RoB2---------- Rossmoyne	3d	Slight	Slight	Moderate	Moderate	White oak----------- White ash----------- Northern red oak---- Sugar maple--------- Slippery elm-------- American beech------ American sycamore---	61 --- 80 --- --- --- ---	White ash, Virginia pine, yellow-poplar, eastern white pine, black oak.
RyA, RyB2, RyC2, RyC3-------------- Ryker	1a	Slight	Slight	Slight	Slight	White oak----------- Yellow-poplar------- Sweetgum------------	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash, black locust.
SwB2--------------- Switzerland	1a	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar------- Virginia pine------- Shortleaf pine------ White oak----------- Sweetgum------------	86 98 --- --- --- ---	Eastern white pine, yellow-poplar, black walnut, white ash, red pine.
SxC2*: Switzerland-------	1a	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar------- Virginia pine------- Shortleaf pine------ White oak----------- Sweetgum------------	86 98 --- --- --- ---	Eastern white pine, yellow-poplar, black walnut, white ash, red pine.
Carmel------------	1c	Slight	Slight	Severe	Severe	Northern red oak---- Yellow-poplar------- Virginia pine------- Shortleaf pine------ Eastern white pine-- Sweetgum------------	86 98 --- --- --- ---	Eastern white pine, yellow-poplar, black walnut, white ash, red pine.
TrC2--------------- Trappist	3c	Slight	Moderate	Slight	Slight	Northern red oak---- Virginia pine-------	70 69	Shortleaf pine, Virginia pine, loblolly pine, eastern white pine.
TrD2--------------- Trappist	3c	Moderate	Severe	Slight	Slight	Northern red oak---- Virginia pine-------	70 69	Shortleaf pine, Virginia pine, loblolly pine, eastern white pine.
TtC3--------------- Trappist	4c	Slight	Moderate	Moderate	Slight	Northern red oak---- Virginia pine-------	55 63	Shortleaf pine, Virginia pine, loblolly pine, eastern white pine.
TtD3--------------- Trappist	4c	Moderate	Severe	Moderate	Slight	Northern red oak---- Virginia pine-------	55 63	Shortleaf pine, Virginia pine, loblolly pine, eastern white pine.
Wt----------------- Wirt	1a	Slight	Slight	Slight	Slight	Yellow-poplar-------	95	Eastern white pine, black walnut, yellow-poplar, black locust.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
AvA, AvB2--------- Avonburg	---	Arrowwood, eastern redcedar, Washington hawthorn, Amur honeysuckle, American cranberrybush, Amur privet, Tatarian honeysuckle.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
BeD3*:					
Beasley-----------	---	American plum, Amur honeysuckle, autumn-olive.	Amur maple, eastern redcedar, Russian-olive.	American sycamore, Austrian pine, eastern white pine.	European alder, silver maple.
Rock outcrop.					
BnC2, BnC3, BnD2, BnD3, BnE-------- Bonnell	---	Eastern redcedar, Washington hawthorn, Amur honeysuckle, Amur privet, American cranberrybush, arrowwood, Tatarian honeysuckle.	Austrian pine, green ash, osageorange.	Pin oak, eastern white pine.	---
CaF*:					
Caneyville--------	---	American plum, Amur honeysuckle, autumn-olive.	Amur maple, eastern redcedar, Russian-olive.	American sycamore, Austrian pine, eastern white pine.	European alder, silver maple.
Rock outcrop.					
CcC2, CdC3-------- Carmel	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
CnB2, CnC2, CnC3-- Cincinnati	---	Eastern redcedar, Washington hawthorn, Tatarian honeysuckle, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Green ash, Austrian pine, osageorange.	Pin oak, eastern white pine.	---
Co----------------- Cobbsfork	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn, Norway spruce.	Eastern white pine	Pin oak.

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
CrB2 Crider Variant	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Da, Db Dearborn	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
DeB2, DeC2, DeC3 Deputy	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Du*. Dumps					
EeD2, EfF. Eden					
EgG*: Eden.					
Caneyville	---	American plum, Amur honeysuckle, autumn-olive.	Amur maple, eastern redcedar, Russian-olive.	American sycamore, Austrian pine, eastern white pine.	European alder, silver maple.
EkA, EkB Elkinsville	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Pin oak, eastern white pine.
GrC2, GrC3, GrD2, GrD3 Grayford	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Ha Haymond	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
HkC2, HkC3, HkD2, HkD3, HkE Hickory	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Ho Holton	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Austrian pine, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Hu Huntington	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
JnB2, JnC2, JnC3 Jennings	---	American cranberrybush, Tatarian honeysuckle, Amur honeysuckle, arrowwood, eastern redcedar, Washington hawthorn, Amur privet.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
MaB2, MaC2 Markland	---	Arrowwood, Washington hawthorn, eastern redcedar, Amur honeysuckle, American cranberrybush, Tatarian honeysuckle, Amur privet.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
NeB2, NeC2 Negley	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
NnB2 Nicholson	---	American plum, Amur honeysuckle, autumn-olive.	Amur maple, eastern redcedar, Russian-olive.	American sycamore, eastern cottonwood, Austrian pine, European alder, eastern white pine, silver maple.	---
PeE Pate	---	Eastern redcedar, Washington hawthorn, Amur honeysuckle, Amur privet, American cranberrybush, arrowwood, Tatarian honeysuckle.	Austrian pine, green ash, osageorange.	Pin oak, eastern white pine.	---
PkB Pekin	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
Pu*. Pits					

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ra----------------- Rahm	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
RoA, RoB2--------- Rossmoyne	---	Washington hawthorn, Amur honeysuckle, Amur privet, Tatarian honeysuckle, eastern redcedar, arrowwood, American cranberrybush.	Austrian pine, osageorange, green ash.	Pin oak, eastern white pine.	---
RyA, RyB2, RyC2, RyC3------------- Ryker	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
SwB2-------------- Switzerland	---	Eastern redcedar, Washington hawthorn, Amur honeysuckle, Amur privet, American cranberrybush, arrowwood, Tatarian honeysuckle.	Austrian pine, green ash, osageorange.	Pin oak, eastern white pine.	---
SxC2*: Switzerland------	---	Eastern redcedar, Washington hawthorn, Amur honeysuckle, Amur privet, American cranberrybush, arrowwood, Tatarian honeysuckle.	Austrian pine, green ash, osageorange.	Pin oak, eastern white pine.	---
Carmel-----------	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
TrC2, TrD2, TtC3, TtD3. Trappist					
Ud*. Udorthents					
Wt---------------- Wirt	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AvA, AvB2------------- Avonburg	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
BeD3*:					
Beasley---------------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Rock outcrop.					
BnC2, BnC3------------ Bonnell	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
BnD2, BnD3------------ Bonnell	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
BnE------------------- Bonnell	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
CaF*:					
Caneyville------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Rock outcrop.					
CcC2, CdC3------------ Carmel	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: slope.
CnB2------------------ Cincinnati	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight----------	Slight.
CnC2, CnC3------------ Cincinnati	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Co-------------------- Cobbsfork	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.
CrB2------------------ Crider Variant	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
Da-------------------- Dearborn	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Db-------------------- Dearborn	Severe: flooding.	Moderate: flooding.	Severe: small stones, flooding.	Moderate: flooding.	Severe: flooding.
DeB2------------------ Deputy	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
DeC2, DeC3 Deputy	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: wetness, slope.
Du*. Dumps					
EeD2 Eden	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, small stones.	Severe: slope.
EfF Eden	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
EgG*: Eden	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Caneyville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
EkA Elkinsville	Severe: flooding.	Slight	Slight	Slight	Slight.
EkB Elkinsville	Severe: flooding.	Slight	Moderate: slope.	Slight	Slight.
GrC2, GrC3 Grayford	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
GrD2, GrD3 Grayford	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Ha Haymond	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
HkC2, HkC3 Hickory	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
HkD2, HkD3 Hickory	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
HkE Hickory	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Ho Holton	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: large stones, wetness, flooding.
Hu Huntington	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
JnB2 Jennings	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
JnC2, JnC3 Jennings	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: slope.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
MaB2: Markland	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
MaC2: Markland	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
NeB2: Negley	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
NeC2: Negley	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
NnB2: Nicholson	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
PeE: Pate	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, erodes easily.	Severe: slope.
PkB: Pekin	Severe: flooding, percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
Pu*. Pits					
Ra: Rahm	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
RoA: Rossmoyne	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
RoB2: Rossmoyne	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
RyA: Ryker	Slight	Slight	Slight	Slight	Slight.
RyB2: Ryker	Slight	Slight	Moderate: slope.	Slight	Slight.
RyC2, RyC3: Ryker	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
SwB2: Switzerland	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
SxC2*:					
Switzerland	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Slight	Slight.
Carmel	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: slope.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
TrC2: Trappist	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope, thin layer.
TrD2: Trappist	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
TtC3: Trappist	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope, thin layer.
TtD3: Trappist	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Ud*. Udorthents					
Wt: Wirt	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
AvA Avonburg	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
AvB2 Avonburg	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BeD3*:										
Beasley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Rock outcrop.										
BnC2, BnC3 Bonnell	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
BnD2, BnD3 Bonnell	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
BnE Bonnell	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
CaF*:										
Caneyville	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Rock outcrop.										
CcC2, CdC3 Carmel	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CnB2 Cincinnati	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CnC2, CnC3 Cincinnati	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Co Cobbsfork	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
CrB2 Crider Variant	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Da, Db Dearborn	Poor	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
DeB2 Deputy	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
DeC2, DeC3 Deputy	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Du*. Dumps										
EeD2 Eden	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
EfF Eden	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
EgG*:										
Eden	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Caneyville	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
EkA, EkB Elkinsville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
GrC2, GrC3 Grayford	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
GrD2, GrD3 Grayford	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Ha Haymond	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
HkC2, HkC3 Hickory	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
HkD2, HkD3 Hickory	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
HkE Hickory	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Ho Holton	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
Hu Huntington	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
JnB2 Jennings	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
JnC2, JnC3 Jennings	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
MaB2 Markland	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
MaC2 Markland	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
NeB2 Negley	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
NeC2 Negley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
NnB2 Nicholson	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
PeE Pate	Good	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
PkB Pekin	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Pu*. Pits										
Ra Rahm	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
RoA----------------- Rossmoyne	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
RoB2---------------- Rossmoyne	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
RyA, RyB2----------- Ryker	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
RyC2, RyC3---------- Ryker	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
SwB2---------------- Switzerland	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
SxC2*:										
Switzerland--------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Carmel-------------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
TrC2---------------- Trappist	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
TrD2---------------- Trappist	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
TtC3---------------- Trappist	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
TtD3---------------- Trappist	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Ud*. Udorthents										
Wt------------------ Wirt	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AvA, AvB2: Avonburg	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
BeD3*:						
Beasley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
Rock outcrop.						
BnC2, BnC3: Bonnell	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
BnD2, BnD3, BnE: Bonnell	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
CaF*:						
Caneyville	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Rock outcrop.						
CcC2, CdC3: Carmel	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
CnB2: Cincinnati	Moderate: dense layer, wetness.	Slight	Moderate: wetness.	Moderate: slope.	Severe: low strength, frost action.	Slight.
CnC2, CnC3: Cincinnati	Moderate: dense layer, wetness, slope.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
Co: Cobbsfork	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
CrB2: Crider Variant	Moderate: depth to rock, too clayey.	Slight	Moderate: depth to rock.	Moderate: slope.	Severe: low strength, frost action.	Slight.
Da, Db: Dearborn	Moderate: large stones, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
DeB2: Deputy	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Severe: low strength.	Moderate: wetness.
DeC2, DeC3: Deputy	Severe: wetness.	Moderate: wetness, slope.	Severe: wetness.	Severe: slope.	Severe: low strength.	Moderate: wetness, slope.
Du*. Dumps						
EeD2, EfF: Eden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
EgG*:						
Eden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
Caneyville	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
EkA, EkB Elkinsville	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, frost action.	Slight.
GrC2, GrC3 Grayford	Moderate: depth to rock, too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Severe: frost action.	Moderate: slope.
GrD2, GrD3 Grayford	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
Ha Haymond	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
HkC2, HkC3 Hickory	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
HkD2, HkD3, HkE Hickory	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Ho Holton	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Moderate: large stones, wetness, flooding.
Hu Huntington	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
JnB2 Jennings	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Slight.
JnC2, JnC3 Jennings	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
MaB2 Markland	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
MaC2 Markland	Moderate: too clayey, wetness, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
NeB2 Negley	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
NeC2 Negley	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
NnB2----------------- Nicholson	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Severe: low strength.	Moderate: wetness.
PeE----------------- Pate	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
PkB----------------- Pekin	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, frost action.	Slight.
Pu*. Pits						
Ra------------------ Rahm	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
RoA----------------- Rossmoyne	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Moderate: wetness.
RoB2---------------- Rossmoyne	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Moderate: wetness.
RyA----------------- Ryker	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
RyB2---------------- Ryker	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
RyC2, RyC3---------- Ryker	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
SwB2---------------- Switzerland	Moderate: too clayey.	Moderate: shrink-swell.	Severe: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
SxC2*:						
Switzerland-------	Moderate: too clayey.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Slight.
Carmel------------	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
TrC2---------------- Trappist	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: low strength.	Moderate: slope, thin layer.
TrD2---------------- Trappist	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
TtC3---------------- Trappist	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: low strength.	Moderate: slope, thin layer.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
TtD3--------------- Trappist	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Ud*. Udorthents						
Wt----------------- Wirt	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AvA------------------ Avonburg	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness.	Severe: wetness.	Poor: wetness.
AvB2----------------- Avonburg	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
BeD3*:					
Beasley------------	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, too clayey, depth to rock.	Severe: slope.	Poor: slope, too clayey, hard to pack.
Rock outcrop.					
BnC2, BnC3---------- Bonnell	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
BnD2, BnD3, BnE----- Bonnell	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: too clayey, hard to pack, slope.
CaF*:					
Caneyville---------	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
Rock outcrop.					
CcC2, CdC3---------- Carmel	Severe: percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock, slope.	Poor: too clayey, hard to pack.
CnB2---------------- Cincinnati	Severe: percs slowly.	Moderate: seepage, slope, wetness.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
CnC2, CnC3---------- Cincinnati	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Co------------------ Cobbsfork	Severe: ponding, percs slowly.	Slight-----------	Severe: ponding.	Severe: ponding.	Poor: ponding.
CrB2---------------- Crider Variant	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock.	Moderate: depth to rock.	Poor: thin layer.
Da, Db-------------- Dearborn	Severe: flooding.	Severe: flooding.	Severe: flooding, large stones.	Severe: flooding.	Poor: large stones.
DeB2---------------- Deputy	Severe: wetness, percs slowly.	Severe: wetness.	Severe: depth to rock, wetness, too clayey.	Moderate: depth to rock, wetness.	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
DeC2, DeC3 Deputy	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: depth to rock, wetness, too clayey.	Moderate: depth to rock, wetness, slope.	Poor: too clayey, hard to pack.
Du*. Dumps					
EeD2 Eden	Severe: slope, percs slowly, depth to rock.	Severe: slope.	Severe: too clayey, depth to rock.	Severe: slope, depth to rock.	Poor: area reclaim, slope, too clayey.
EfF Eden	Severe: slope, percs slowly, depth to rock.	Severe: slope.	Severe: slope, too clayey, depth to rock.	Severe: slope, depth to rock.	Poor: area reclaim, slope, too clayey.
EgG*:					
Eden	Severe: slope, percs slowly, depth to rock.	Severe: slope.	Severe: slope, too clayey, depth to rock.	Severe: slope, depth to rock.	Poor: area reclaim, slope, too clayey.
Caneyville	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
EkA Elkinsville	Moderate: flooding.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
EkB Elkinsville	Moderate: flooding.	Moderate: seepage, slope.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
GrC2, GrC3 Grayford	Moderate: depth to rock, percs slowly, slope.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock, slope.	Fair: area reclaim, too clayey, slope.
GrD2, GrD3 Grayford	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
Ha Haymond	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
HkC2, HkC3 Hickory	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
HkD2, HkD3, HkE Hickory	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Ho Holton	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: large stones, wetness.
Hu Huntington	Severe: flooding.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Good.
JnB2 Jennings	Severe: wetness, percs slowly.	Moderate: slope.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
JnC2, JnC3---------- Jennings	Severe: wetness, percs slowly.	Severe: slope.	Moderate: wetness, slope, too clayey.	Moderate: wetness, slope.	Fair: too clayey, slope, wetness.
MaB2---------------- Markland	Severe: wetness, percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
MaC2---------------- Markland	Severe: wetness, percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
NeB2---------------- Negley	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too clayey, small stones.
NeC2---------------- Negley	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too clayey, small stones, slope.
NnB2---------------- Nicholson	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
PeE----------------- Pate	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
PkB----------------- Pekin	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
Pu*. Pits					
Ra------------------ Rahm	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
RoA----------------- Rossmoyne	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
RoB2---------------- Rossmoyne	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
RyA----------------- Ryker	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
RyB2---------------- Ryker	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
RyC2, RyC3---------- Ryker	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
SwB2---------------- Switzerland	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
SxC2*:					
Switzerland	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Carmel	Severe: percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock, slope.	Poor: too clayey, hard to pack.
TrC2 Trappist	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
TrD2 Trappist	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
TtC3 Trappist	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
TtD3 Trappist	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
Ud*. Udorthents					
Wt Wirt	Severe: flooding.	Severe: seepage, flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AvA, AvB2------------- Avonburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
BeD3*:				
Beasley--------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
Rock outcrop.				
BnC2, BnC3------------ Bonnell	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
BnD2, BnD3------------ Bonnell	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
BnE------------------ Bonnell	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
CaF*:				
Caneyville-----------	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
Rock outcrop.				
CcC2, CdC3------------ Carmel	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
CnB2------------------ Cincinnati	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
CnC2, CnC3------------ Cincinnati	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, slope.
Co-------------------- Cobbsfork	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
CrB2------------------ Crider Variant	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Da, Db---------------- Dearborn	Fair: large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
DeB2, DeC2, DeC3------ Deputy	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
Du*. Dumps				
EeD2------------------ Eden	Poor: area reclaim, thin layer, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey, small stones.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
EfF: Eden	Poor: area reclaim, slope, thin layer, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey, small stones.
EgG*:				
Eden	Poor: area reclaim, slope, thin layer, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey, small stones.
Caneyville	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
EkA, EkB: Elkinsville	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
GrC2, GrC3: Grayford	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim, slope.
GrD2, GrD3: Grayford	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Ha: Haymond	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
HkC2, HkC3: Hickory	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
HkD2, HkD3: Hickory	Fair: low strength, shrink-swell, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
HkE: Hickory	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Ho: Holton	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, area reclaim.
Hu: Huntington	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
JnB2: Jennings	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
JnC2, JnC3: Jennings	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
MaB2, MaC2: Markland	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
NeB2, NeC2: Negley	Good	Probable	Probable	Poor: small stones.
NnB2: Nicholson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
PeE------------------- Pate	Poor: low strength, slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
PkB------------------- Pekin	Fair: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Pu*. Pits				
Ra-------------------- Rahm	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
RoA, RoB2------------- Rossmoyne	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
RyA, RyB2------------- Ryker	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
RyC2, RyC3------------ Ryker	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
SwB2------------------ Switzerland	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
SxC2*:				
Switzerland-----------	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Carmel----------------	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
TrC2------------------ Trappist	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
TrD2------------------ Trappist	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, thin layer.
TtC3------------------ Trappist	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
TtD3------------------ Trappist	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, thin layer.
Ud*. Udorthents				
Wt-------------------- Wirt	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
AvA----------------- Avonburg	Moderate: seepage.	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Erodes easily, wetness, rooting depth.	Wetness, erodes easily, rooting depth.
AvB2---------------- Avonburg	Moderate: seepage, slope.	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness, rooting depth.	Wetness, erodes easily, rooting depth.
BeD3*: Beasley-----------	Severe: slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Rock outcrop.						
BnC2, BnC3, BnD2, BnD3, BnE--------- Bonnell	Severe: slope.	Slight----------	Severe: no water.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
CaF*: Caneyville--------	Severe: slope.	Severe: thin layer, hard to pack.	Severe: no water.	Deep to water	Slope, depth to rock.	Slope, depth to rock.
Rock outcrop.						
CcC2, CdC3--------- Carmel	Severe: slope.	Moderate: thin layer, hard to pack.	Severe: no water.	Deep to water	Slope, large stones, erodes easily.	Slope, erodes easily.
CnB2---------------- Cincinnati	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily, rooting depth.	Erodes easily, rooting depth.
CnC2, CnC3--------- Cincinnati	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, erodes easily, rooting depth.	Slope, erodes easily, rooting depth.
Co------------------ Cobbsfork	Slight----------	Severe: piping, ponding.	Severe: no water.	Ponding, percs slowly, frost action.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, rooting depth.
CrB2---------------- Crider Variant	Moderate: seepage, depth to rock, slope.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
Da------------------ Dearborn	Moderate: seepage.	Severe: piping, large stones.	Severe: no water.	Deep to water	Large stones, erodes easily.	Large stones, erodes easily, droughty.
Db------------------ Dearborn	Moderate: seepage.	Severe: piping, large stones.	Severe: no water.	Deep to water	Large stones---	Large stones, droughty.
DeB2---------------- Deputy	Moderate: seepage, depth to rock, slope.	Severe: hard to pack.	Severe: no water.	Slope-----------	Erodes easily, wetness.	Erodes easily.
DeC2, DeC3--------- Deputy	Severe: slope.	Severe: hard to pack.	Severe: no water.	Slope-----------	Slope, erodes easily, wetness.	Slope, erodes easily.
Du*. Dumps						

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
EeD2, EfF---------- Eden	Severe: slope.	Moderate: hard to pack, thin layer, large stones.	Severe: no water.	Deep to water	Slope, percs slowly, large stones.	Slope, large stones, percs slowly.
EgG*:						
Eden--------------	Severe: slope.	Moderate: hard to pack, thin layer, large stones.	Severe: no water.	Deep to water	Slope, percs slowly, large stones.	Slope, large stones, percs slowly.
Caneyville--------	Severe: slope.	Severe: thin layer, hard to pack.	Severe: no water.	Deep to water	Slope, depth to rock, erodes easily.	Slope, depth to rock, erodes easily.
EkA---------------- Elkinsville	Moderate: seepage.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
EkB---------------- Elkinsville	Moderate: seepage, slope.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
GrC2, GrC3, GrD2, GrD3------------- Grayford	Severe: slope.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Ha----------------- Haymond	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
HkC2, HkC3, HkD2, HkD3, HkE-------- Hickory	Severe: slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Ho----------------- Holton	Moderate: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Flooding, large stones, frost action.	Large stones, erodes easily, wetness.	Large stones, wetness, erodes easily.
Hu----------------- Huntington	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Favorable-------	Favorable.
JnB2--------------- Jennings	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Erodes easily, rooting depth.
JnC2, JnC3--------- Jennings	Severe: slope.	Severe: piping.	Severe: no water.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
MaB2--------------- Markland	Moderate: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Erodes easily, percs slowly.	Erodes easily, percs slowly.
MaC2--------------- Markland	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
NeB2--------------- Negley	Severe: seepage.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Favorable-------	Favorable.
NeC2--------------- Negley	Severe: seepage, slope.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Slope-----------	Slope.
NnB2--------------- Nicholson	Slight----------	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Erodes easily, wetness.	Erodes easily, rooting depth.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
PeE---------------- Pate	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, large stones, erodes easily.	Slope, erodes easily, droughty.
PkB---------------- Pekin	Moderate: seepage.	Severe: piping.	Severe: slow refill.	Percs slowly, frost action.	Erodes easily, wetness.	Erodes easily, rooting depth.
Pu*. Pits						
Ra----------------- Rahm	Slight----------	Severe: wetness.	Severe: slow refill.	Percs slowly, flooding, frost action.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
RoA---------------- Rossmoyne	Moderate: seepage.	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Erodes easily, wetness, percs slowly.	Erodes easily, rooting depth.
RoB2--------------- Rossmoyne	Moderate: seepage, slope.	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness, percs slowly.	Erodes easily, rooting depth.
RyA---------------- Ryker	Moderate: seepage.	Slight----------	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
RyB2--------------- Ryker	Moderate: seepage, slope.	Slight----------	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
RyC2, RyC3--------- Ryker	Severe: slope.	Slight----------	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
SwB2--------------- Switzerland	Moderate: seepage, slope.	Moderate: thin layer, hard to pack.	Severe: no water.	Deep to water	Erodes easily, percs slowly.	Erodes easily, percs slowly.
SxC2*: Switzerland-------	Moderate: seepage, slope.	Moderate: thin layer, hard to pack.	Severe: no water.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
Carmel------------	Severe: slope.	Moderate: thin layer, hard to pack.	Severe: no water.	Deep to water	Slope, large stones, erodes easily.	Slope, erodes easily.
TrC2, TrD2, TtC3, TtD3-------------- Trappist	Moderate: depth to rock.	Severe: thin layer, hard to pack.	Severe: no water.	Deep to water	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Ud*. Udorthents						
Wt----------------- Wirt	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AvA, AvB2-------- Avonburg	0-10	Silt loam--------	CL, ML, CL-ML	A-4	0	100	100	95-100	75-95	20-30	2-10
	10-30	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	75-95	30-45	10-20
	30-80	Silty clay loam, clay loam, silt loam.	CL	A-6, A-7	0-3	95-100	95-100	90-100	70-95	30-45	10-20
BeD3*: Beasley---------	0-3	Silt loam--------	ML, CL, CL-ML	A-4	0-5	90-100	85-100	80-100	75-100	25-35	4-10
	3-22	Silty clay, clay	CH, CL	A-7	0-5	90-100	85-100	85-100	75-100	45-70	20-40
	22-44	Silty clay, clay loam, cherty silty clay.	CL, CH	A-7	0-10	70-100	55-100	50-100	50-95	40-65	15-35
	44	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											
BnC2, BnC3, BnD2, BnD3, BnE-------- Bonnell	0-7	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	65-90	25-35	4-12
	7-55	Clay loam, clay, silt loam.	CL	A-6, A-7	0-5	95-100	90-100	85-95	60-80	35-50	20-30
	55-80	Clay loam--------	CL	A-6, A-7	0-10	95-100	90-100	85-95	60-80	35-50	20-30
CaF*: Caneyville------	0-5	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	75-100	60-95	20-35	2-12
	5-12	Silty clay, clay, silty clay loam.	CH, CL	A-7	0-3	90-100	85-100	75-100	65-100	42-70	20-45
	12-34	Clay, silty clay	CH	A-7	0-3	90-100	85-100	75-100	65-100	50-75	30-45
	34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
CcC2------------- Carmel	0-6	Silt loam--------	ML, CL	A-4, A-6	0	100	100	90-100	80-97	25-40	1-15
	6-17	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-95	25-45	10-20
	17-43	Clay, silty clay	CH	A-7	0-10	100	100	90-100	75-97	50-65	30-40
	43-50	Flaggy clay, very flaggy silty clay.	CL, CH	A-7	40-80	90-100	85-100	80-100	65-95	40-60	18-32
	50	Weathered bedrock	---	---	---	---	---	---	---	---	---
CdC3------------- Carmel	0-6	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-95	25-45	10-20
	6-41	Clay, silty clay	CH	A-7	0-10	100	100	90-100	75-97	50-65	30-40
	41	Weathered bedrock	---	---	---	---	---	---	---	---	---
CnB2, CnC2, CnC3- Cincinnati	0-6	Silt loam--------	ML, CL	A-4, A-6	0	100	100	90-100	80-100	25-40	3-16
	6-33	Silty clay loam, loam, silt loam.	CL	A-6, A-4	0	95-100	90-100	90-100	70-100	26-40	8-15
	33-56	Clay loam, loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	95-100	85-100	75-95	65-85	25-40	6-20
	56-80	Clay loam, silty clay loam, loam.	CL, ML, CL-ML	A-6, A-4	0	95-100	85-100	75-95	65-85	25-40	5-20
Co--------------- Cobbsfork	0-12	Silt loam--------	CL, ML, CL-ML	A-4	0	100	100	90-100	70-90	15-30	3-10
	12-27	Silt loam--------	CL, ML, CL-ML	A-4	0	100	100	90-100	70-95	15-30	3-10
	27-50	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	95-100	75-95	20-35	5-15
	50-77	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	95-100	75-95	20-35	5-15
	77-80	Clay loam--------	CL	A-6	0	100	95-100	90-100	75-90	30-40	10-15

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
CrB2------------- Crider Variant	0-7	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	85-100	20-35	4-15
	7-39	Silt loam, silty clay loam.	CL, ML	A-6, A-4	0	100	95-100	90-100	85-100	20-40	7-20
	39-58	Clay, silty clay	CH, MH	A-7	0	100	95-100	90-100	85-100	40-65	15-30
	58	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Da--------------- Dearborn	0-6	Silt loam--------	CL-ML, CL	A-4, A-6	0-10	90-95	85-95	70-95	55-85	25-40	5-20
	6-13	Clay loam, silt loam, loam.	CL, SC	A-6, A-7	0-20	85-90	75-90	65-90	45-80	30-45	10-20
	13-60	Channery loam, channery silt loam.	CL-ML, CL, GC, SC	A-4, A-6, A-2-4, A-2-6	25-50	65-75	50-75	50-75	30-60	25-40	4-15
Db--------------- Dearborn	0-11	Channery silt loam.	CL-ML, CL, GM-GC, GC	A-4, A-6	0-10	65-80	60-80	55-80	45-70	25-35	6-12
	11-28	Very gravelly coarse loamy sand, gravelly loam.	CL, SC	A-6, A-7	0-20	85-90	75-90	65-90	45-80	30-45	10-20
	28-60	Very gravelly coarse sandy loam, very flaggy loamy sand.	CL-ML, CL, GC, SC	A-4, A-6, A-2-4, A-2-6	25-50	65-75	50-75	50-75	30-60	25-40	4-15
DeB2, DeC2, DeC3- Deputy	0-8	Silt loam--------	ML, CL-ML, CL	A-4	0	95-100	95-100	95-100	90-100	<30	NP-10
	8-27	Silt loam, silty clay loam.	CL, ML	A-6, A-7	0	95-100	95-100	95-100	90-100	25-45	10-20
	27-53	Silty clay, clay	CL, CH	A-7	0	75-100	70-100	60-95	60-90	40-60	15-30
	53-77	Weathered bedrock	---	---	---	---	---	---	---	---	---
	77	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Du*. Dumps											
EeD2------------- Eden	0-5	Silty clay loam	ML, CL, MH, CH	A-7, A-6	0-15	85-100	80-100	75-100	70-100	35-65	12-35
	5-21	Flaggy silty clay, flaggy clay, silty clay.	MH, CH, CL	A-7	10-45	75-100	70-100	65-100	65-95	45-75	20-45
	21	Weathered bedrock	---	---	---	---	---	---	---	---	---
EfF-------------- Eden	0-11	Flaggy silty clay loam.	ML, CL, MH, CH	A-7, A-6	25-40	75-95	70-95	70-95	65-95	35-65	12-35
	11-39	Flaggy silty clay, flaggy clay, silty clay.	MH, CH, CL	A-7	10-45	75-100	70-100	65-100	65-95	45-75	20-45
	39	Weathered bedrock	---	---	---	---	---	---	---	---	---
EgG*: Eden------------	0-4	Flaggy silty clay loam, flaggy silt loam.	ML, CL, MH, CH	A-7, A-6	25-40	75-95	70-95	70-95	65-95	35-65	12-35
	4-34	Flaggy silty clay, flaggy clay, silty clay.	MH, CH, CL	A-7	10-45	75-100	70-100	65-100	65-95	45-75	20-45
	34	Weathered bedrock	---	---	---	---	---	---	---	---	---
Caneyville------	0-5	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	75-100	60-95	20-35	2-12
	5-12	Silty clay, clay, silty clay loam.	CH, CL	A-7	0-3	90-100	85-100	75-100	65-100	42-70	20-45
	12-34	Clay, silty clay	CH	A-7	0-3	90-100	85-100	75-100	65-100	50-75	30-45
	34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
EkA, EkB---------- Elkinsville	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-40	5-15
	8-36	Silty clay loam, silt loam.	CL	A-6, A-4	0	100	100	85-100	65-90	30-40	8-18
	36-60	Silty clay loam, loam, sandy clay loam.	CL	A-4, A-6	0	100	100	80-100	50-90	30-40	8-18
GrC2, GrC3, GrD2, GrD3------------ Grayford	0-12	Silt loam--------	CL-ML, CL	A-4	0	100	100	90-100	70-90	18-30	4-10
	12-22	Silty clay loam, silt loam.	CL	A-6, A-4	0	100	95-100	95-100	80-95	25-35	8-13
	22-45	Clay loam, silty clay loam, loam.	CL	A-6, A-4	0-5	95-100	85-100	75-100	60-95	25-40	8-15
	45-52	Clay, silty clay	CH, CL	A-7	0-10	95-100	65-95	60-90	50-85	45-55	20-30
	52	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Ha---------------- Haymond	0-10	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
	10-43	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
	43-60	Fine sandy loam, silt loam, loam.	ML, SM	A-4	0	95-100	90-100	80-100	35-90	27-36	4-10
HkC2, HkC3, HkD2, HkD3, HkE-------- Hickory	0-9	Silt loam--------	CL	A-6, A-4	0-5	95-100	90-100	90-100	85-95	20-35	8-15
	9-54	Clay loam, silty clay loam, silt loam.	CL	A-6, A-7	0-5	100	90-100	80-95	75-90	30-50	15-30
	54-60	Clay loam, sandy loam, loam.	CL-ML, CL	A-4, A-6	0-5	85-100	85-95	80-95	60-80	20-40	5-20
Ho---------------- Holton	0-8	Loam-------------	CL, CL-ML, ML	A-4	0-20	90-100	85-100	80-100	60-90	<25	2-10
	8-32	Fine sandy loam, loam, loamy sand.	CL-ML, CL, SM-SC, SC	A-4, A-2, A-6	0-20	90-100	85-100	60-95	30-75	<25	4-12
	32-60	Stratified loamy fine sand to sandy clay loam.	SC, SM-SC, CL, CL-ML	A-4, A-2, A-6	0-40	75-100	60-100	55-90	30-55	<25	2-14
Hu---------------- Huntington	0-17	Silt loam--------	ML, CL	A-4, A-6	0	95-100	95-100	85-100	60-95	25-40	5-15
	17-60	Silt loam, loam, silty clay loam.	ML, CL	A-4, A-6	0	95-100	95-100	85-100	60-95	25-40	5-15
JnB2, JnC2, JnC3- Jennings	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	80-95	20-35	5-15
	8-27	Silty clay loam, silt loam.	CL	A-6, A-4	0	100	95-100	90-100	80-95	25-40	8-20
	27-51	Silty clay loam, clay loam, silt loam.	CL, CL-ML	A-6, A-4	0	100	95-100	90-100	75-90	20-40	5-20
	51-68	Shaly silty clay, silty clay loam.	CL, CH, ML, MH	A-6, A-7	0-5	95-100	85-95	75-90	65-85	30-55	10-25
	68	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
MaB2, MaC2-------- Markland	0-7	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	7-29	Silty clay, clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	90-95	45-60	19-32
	29-60	Stratified clay to silty clay loam.	CL, CH	A-7	0	100	100	90-100	75-95	40-55	15-25
NeB2, NeC2-------- Negley	0-17	Silt loam, silty clay loam.	ML, CL-ML, CL	A-4, A-6	0	85-100	75-100	70-90	55-85	25-40	4-12
	17-63	Loam, gravelly clay loam, gravelly sandy loam.	SM, ML	A-4, A-2, A-6, A-7	0-5	70-95	50-90	35-80	20-60	25-45	3-17
	63-80	Gravelly sandy clay loam, sandy clay loam, sandy clay.	SM-SC, SC	A-2, A-4, A-7, A-6	0-5	70-95	50-90	40-80	25-50	20-50	5-24

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
NnB2------------- Nicholson	0-8	Silt loam--------	ML, CL, CL-ML	A-4	0	95-100	95-100	85-100	80-95	25-35	5-10
	8-26	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-4, A-7	0	95-100	85-100	85-100	80-100	25-45	5-20
	26-42	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-4, A-7	0	95-100	90-100	80-100	75-95	25-45	5-20
	42-72	Silty clay, clay, channery clay.	CH, CL	A-6, A-7	0-10	80-100	70-100	60-100	55-95	34-70	16-40
PeE-------------- Pate	0-8	Silty clay loam	CL	A-6, A-7	0-5	90-100	85-100	80-100	75-100	35-50	20-32
	8-50	Silty clay loam, silty clay, clay.	CL, CH	A-7	0-5	90-100	85-100	80-100	70-100	45-65	25-40
	50-65	Channery silty clay loam, very flaggy clay.	CL, CH	A-6, A-7	5-40	75-100	70-100	65-100	60-75	25-55	10-30
	65	Weathered bedrock	---	---	---	---	---	---	---	---	---
PkB-------------- Pekin	0-7	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	85-100	65-100	20-30	5-15
	7-25	Silt loam, silty clay loam.	CL	A-6	0	100	100	90-100	70-100	25-40	10-20
	25-57	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	88-98	65-90	25-35	5-15
	57-60	Stratified fine sandy loam to silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	80-95	50-85	20-40	5-15
Pu*. Pits											
Ra--------------- Rahm	0-10	Silty clay loam	CL	A-6	0	100	100	90-100	75-95	25-40	10-20
	10-78	Silty clay loam, silt loam, silty clay.	CL	A-6	0	100	100	90-100	85-95	25-40	10-20
	78-80	Silty clay loam, silty clay.	CL	A-6, A-7	0	100	100	95-100	85-95	30-45	10-20
RoA, RoB2-------- Rossmoyne	0-8	Silt loam--------	ML	A-4	0	90-100	90-100	90-100	85-100	30-40	4-10
	8-25	Silty clay loam, silt loam, clay loam.	CL, ML	A-6, A-7, A-4	0	90-100	90-100	85-100	75-95	30-48	8-20
	25-80	Clay loam, silt loam, silty clay loam.	CL	A-6, A-4	0	90-100	85-95	80-90	70-85	25-40	9-19
RyA, RyB2, RyC2, RyC3------------ Ryker	0-6	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	90-100	80-95	20-30	5-15
	6-67	Silt loam, silty clay loam.	CL	A-6	0	100	100	90-100	75-95	25-40	10-15
	67-80	Silt loam, silty clay loam, clay loam.	CL	A-6, A-7	0	85-100	80-100	75-95	60-85	25-45	10-20
SwB2------------- Switzerland	0-11	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	95-100	90-100	80-100	20-40	5-15
	11-26	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	85-100	25-45	15-25
	26-80	Silty clay, clay, flaggy clay.	CL, CH	A-7	0	95-100	90-100	85-100	75-95	45-65	25-40
	80	Weathered bedrock	---	---	---	---	---	---	---	---	---
SxC2*: Switzerland-----	0-5	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	95-100	90-100	80-100	20-40	5-15
	5-25	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	85-100	25-45	15-25
	25-60	Silty clay, clay	CL, CH	A-7	0	95-100	90-100	85-100	75-95	45-65	25-40

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
SxC2*:											
Carmel----------	0-5	Silt loam--------	ML, CL	A-4, A-6	0	100	100	90-100	80-97	25-40	1-15
	5-17	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-95	25-45	10-20
	17-37	Clay, silty clay	CH	A-7	0-10	100	100	90-100	75-97	50-65	30-40
	37-48	Flaggy clay, very flaggy silty clay, clay.	CL, CH	A-7	40-80	90-100	85-100	80-100	65-95	40-60	18-32
	48	Weathered bedrock	---	---	---	---	---	---	---	---	---
TrC2, TrD2------- Trappist	0-6	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	60-95	20-35	2-14
	6-31	Silty clay, silty clay loam, shaly silty clay.	CL, MH, CH	A-7, A-6	0	80-100	60-100	55-100	50-95	35-60	12-30
	31-38	Very shaly clay, shaly silty clay loam, shaly clay.	GC, CL, MH, CH	A-2, A-7, A-6	0-5	30-75	20-65	20-60	15-60	35-60	12-30
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
TtC3, TtD3------- Trappist	0-8	Silty clay loam	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	60-95	22-40	4-20
	8-33	Silty clay, clay, shaly silty clay.	CL, MH, CH	A-7, A-6	0	80-100	60-100	55-100	50-95	35-60	12-30
	33-39	Very shaly clay, shaly silty clay loam, shaly clay.	GC, CL, MH, CH	A-2, A-7, A-6	0-5	30-75	20-65	20-60	15-60	35-60	12-30
	39	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Ud*. Udorthents											
Wt--------------- Wirt	0-15	Silt loam--------	CL-ML, ML	A-4	0	95-100	90-100	80-100	65-90	<25	3-7
	15-50	Silt loam, loam	CL-ML, ML	A-4	0	95-100	90-100	75-100	55-90	<25	3-7
	50-60	Stratified loam to loamy fine sand.	SM, SM-SC, ML, CL-ML	A-4, A-2	0	95-100	90-100	60-95	20-75	<25	NP-7

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cm^3	In/hr	In/in	pH					Pct
AvA, AvB2-------- Avonburg	0-10	10-18	1.30-1.45	0.6-2.0	0.20-0.24	4.5-7.3	Low-----------	0.43	4	5	.5-2
	10-30	22-30	1.35-1.50	0.6-2.0	0.18-0.20	4.5-5.5	Moderate-----	0.43			
	30-80	22-30	1.60-1.85	<0.06	0.06-0.08	4.5-5.5	Moderate-----	0.43			
BeD3*:											
Beasley---------	0-3	10-27	1.20-1.40	0.6-2.0	0.18-0.23	4.5-7.3	Low-----------	0.43	3	5	.5-4
	3-22	40-60	1.30-1.55	0.2-0.6	0.12-0.18	4.5-7.3	Moderate-----	0.28			
	22-44	40-60	1.50-1.70	0.2-0.6	0.10-0.16	6.6-8.4	Moderate-----	0.28			
	44	---	---	---	---	---	-------------	----			
Rock outcrop.											
BnC2, BnC3, BnD2, BnD3, BnE------- Bonnell	0-7	15-25	1.30-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Low-----------	0.43	3	5	1-3
	7-55	27-40	1.45-1.60	0.06-0.2	0.14-0.19	5.1-6.5	High----------	0.32			
	55-80	27-40	1.45-1.60	0.2-0.6	0.08-0.15	6.1-8.4	Moderate-----	0.32			
CaF*:											
Caneyville------	0-5	10-25	1.20-1.40	0.6-2.0	0.15-0.22	4.5-7.3	Low-----------	0.43	3	5	2-4
	5-12	36-60	1.35-1.60	0.2-0.6	0.12-0.18	4.5-7.3	Moderate-----	0.28			
	12-34	40-60	1.35-1.60	0.2-0.6	0.12-0.18	5.6-7.8	Moderate-----	0.28			
	34	---	---	---	---	---	-------------	----			
Rock outcrop.											
CcC2------------- Carmel	0-6	20-27	1.30-1.50	0.6-2.0	0.22-0.24	5.1-7.3	Low-----------	0.43	4	6	1-4
	6-17	25-40	1.40-1.60	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43			
	17-43	50-60	1.55-1.75	<0.06	0.09-0.11	4.5-6.5	High----------	0.32			
	43-50	40-55	1.55-1.75	<0.06	0.03-0.08	7.4-8.4	Moderate-----	0.32			
	50	---	---	---	---	---	-------------	----			
CdC3------------- Carmel	0-6	27-40	1.40-1.60	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.43	4	7	.5-2
	6-41	50-60	1.55-1.75	<0.06	0.09-0.11	4.5-6.5	High----------	0.32			
	41	---	---	---	---	---	-------------	----			
CnB2, CnC2, CnC3- Cincinnati	0-6	15-25	1.30-1.50	0.6-2.0	0.22-0.24	4.5-7.3	Low-----------	0.37	4-3	6	1-3
	6-33	22-35	1.45-1.65	0.6-2.0	0.15-0.19	4.5-5.5	Low-----------	0.37			
	33-56	24-35	1.60-1.85	0.06-0.6	0.08-0.12	4.5-6.5	Moderate-----	0.37			
	56-80	24-40	1.55-1.75	0.06-0.6	0.08-0.12	4.5-6.5	Moderate-----	0.37			
Co--------------- Cobbsfork	0-12	8-18	1.30-1.60	0.06-0.2	0.22-0.24	4.5-7.3	Low-----------	0.37	4	5	.5-2
	12-27	8-22	1.30-1.60	0.06-0.2	0.20-0.22	4.5-6.5	Low-----------	0.37			
	27-50	15-28	1.40-1.85	<0.06	0.06-0.12	4.5-6.0	Low-----------	0.37			
	50-77	17-28	1.40-1.65	0.06-0.2	0.06-0.12	4.5-6.0	Low-----------	0.37			
	77-80	27-33	1.40-1.65	0.06-0.2	0.12-0.17	5.6-7.3	Moderate-----	0.37			
CrB2------------- Crider Variant	0-7	12-27	1.25-1.40	0.6-2.0	0.19-0.22	5.1-7.3	Low-----------	0.37	5	5	2-4
	7-39	18-35	1.35-1.50	0.6-2.0	0.16-0.22	5.1-7.3	Low-----------	0.37			
	39-58	40-60	1.40-1.60	0.6-2.0	0.12-0.14	5.1-7.3	Moderate-----	0.28			
	58	---	---	---	---	---	-------------	----			
Da--------------- Dearborn	0-6	20-30	1.30-1.45	0.6-2.0	0.17-0.21	7.4-8.4	Low-----------	0.37	3	5	1-3
	6-13	20-35	1.40-1.60	0.6-2.0	0.13-0.17	7.4-8.4	Low-----------	0.28			
	13-60	20-35	1.50-1.75	0.6-2.0	0.05-0.07	7.4-8.4	Low-----------	0.28			
Db--------------- Dearborn	0-11	20-27	1.30-1.45	0.6-2.0	0.12-0.15	7.4-8.4	Low-----------	0.28	3	5	1-3
	11-28	20-35	1.40-1.60	0.6-2.0	0.13-0.17	7.4-8.4	Low-----------	0.28			
	28-60	20-35	1.50-1.75	0.6-2.0	0.05-0.07	7.4-8.4	Low-----------	0.28			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cm^3	In/hr	In/in	pH					Pct
DeB2, DeC2, DeC3-Deputy	0-8	7-27	1.20-1.40	0.6-2.0	0.18-0.22	5.6-7.3	Low-----------	0.37	5	6	1-3
	8-27	20-40	1.20-1.40	0.6-2.0	0.12-0.22	4.5-6.0	Low-----------	0.37			
	27-53	40-60	1.40-1.65	0.2-0.6	0.09-0.14	4.5-5.5	Moderate------	0.28			
	53-77	---	---	---	---	---	-------------	----			
	77	---	---	---	---	---	-------------	----			
Du*. Dumps											
EeD2-------------- Eden	0-5	27-50	1.35-1.55	0.06-0.6	0.12-0.18	5.1-8.4	Moderate------	0.43	3	7	.5-3
	5-21	40-60	1.45-1.65	0.06-0.2	0.08-0.13	5.1-8.4	Moderate------	0.28			
	21	---	---	---	---	---	-------------	0.17			
EfF--------------- Eden	0-11	27-60	1.45-1.65	0.06-0.6	0.11-0.17	5.1-8.4	Moderate------	0.17	3	8	.5-3
	11-39	40-60	1.45-1.65	0.06-0.2	0.08-0.13	5.1-8.4	Moderate------	0.28			
	39	---	---	---	---	---	-------------	0.17			
EgG*:											
Eden-------------	0-4	27-60	1.45-1.65	0.06-0.6	0.11-0.17	5.1-8.4	Moderate------	0.17	3	8	.5-3
	4-34	40-60	1.45-1.65	0.06-0.2	0.08-0.13	5.1-8.4	Moderate------	0.28			
	34	---	---	---	---	---	-------------	0.17			
Caneyville-------	0-5	10-25	1.20-1.40	0.6-2.0	0.15-0.22	4.5-7.3	Low-----------	0.43	3	5	2-4
	5-12	36-60	1.35-1.60	0.2-0.6	0.12-0.18	4.5-7.3	Moderate------	0.28			
	12-34	40-60	1.35-1.60	0.2-0.6	0.12-0.18	5.6-7.8	Moderate------	0.28			
	34	---	---	---	---	---	-------------	----			
EkA, EkB---------- Elkinsville	0-8	15-26	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.37	5	5	1-3
	8-36	22-30	1.40-1.60	0.6-2.0	0.18-0.22	4.5-6.0	Moderate------	0.37			
	36-60	16-30	1.45-1.65	0.6-2.0	0.15-0.20	4.5-5.5	Moderate------	0.37			
GrC2, GrC3, GrD2, GrD3------------- Grayford	0-12	12-25	1.25-1.40	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.37	5-4	5	2-4
	12-22	20-30	1.35-1.50	0.6-2.0	0.18-0.20	4.5-7.3	Moderate------	0.37			
	22-45	20-35	1.40-1.60	0.6-2.0	0.16-0.20	4.5-5.5	Moderate------	0.37			
	45-52	42-50	1.40-1.60	0.6-2.0	0.09-0.11	5.1-6.0	High----------	0.37			
	52	---	---	---	---	---	-------------	----			
Ha---------------- Haymond	0-10	10-18	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.37	5	5	1-3
	10-43	10-18	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.37			
	43-60	10-18	1.30-1.45	0.6-2.0	0.20-0.22	6.1-7.3	Low-----------	0.37			
HkC2, HkC3, HkD2, HkD3, HkE-------- Hickory	0-9	19-25	1.30-1.50	0.6-2.0	0.20-0.22	4.5-6.0	Low-----------	0.37	5	6	1-2
	9-54	27-35	1.45-1.65	0.6-2.0	0.15-0.19	4.5-5.5	Moderate------	0.37			
	54-60	15-32	1.50-1.70	0.6-2.0	0.11-0.19	5.1-8.4	Low-----------	0.37			
Ho---------------- Holton	0-8	5-18	1.20-1.45	0.6-2.0	0.15-0.20	5.6-7.3	Low-----------	0.37	5	5	1-2
	8-32	5-18	1.25-1.45	0.6-2.0	0.13-0.17	5.6-7.3	Low-----------	0.24			
	32-60	5-20	1.25-1.45	0.6-2.0	0.07-0.16	5.6-7.3	Low-----------	0.24			
Hu---------------- Huntington	0-17	18-30	1.10-1.30	0.6-2.0	0.18-0.24	5.6-7.8	Low-----------	0.28	5	6	2-4
	17-60	18-30	1.30-1.50	0.6-2.0	0.16-0.22	5.6-7.8	Low-----------	0.32			
JnB2, JnC2, JnC3-Jennings	0-8	15-27	1.30-1.45	0.6-2.0	0.22-0.24	3.6-7.3	Low-----------	0.37	4	5	.5-2
	8-27	20-35	1.35-1.50	0.6-2.0	0.18-0.22	4.5-5.5	Moderate------	0.37			
	27-51	15-35	1.50-1.75	<0.06	0.06-0.08	3.6-5.5	Moderate------	0.37			
	51-68	27-50	1.40-1.65	0.06-0.2	0.11-0.20	3.6-5.0	Moderate------	0.37			
	68	---	---	---	---	---	-------------	----			
MaB2, MaC2-------- Markland	0-7	20-27	1.30-1.45	0.6-2.0	0.22-0.24	5.1-7.3	Low-----------	0.43	3	5	1-3
	7-29	40-55	1.55-1.70	0.06-0.2	0.11-0.13	5.1-7.3	High----------	0.32			
	29-60	35-50	1.55-1.70	0.06-0.2	0.09-0.11	7.4-8.4	High----------	0.32			
NeB2, NeC2-------- Negley	0-17	12-27	1.30-1.50	2.0-6.0	0.16-0.22	4.5-7.3	Low-----------	0.32	3	5	1-3
	17-63	18-35	1.30-1.60	0.6-6.0	0.10-0.16	4.5-6.5	Low-----------	0.32			
	63-80	22-38	1.20-1.60	0.6-6.0	0.06-0.14	4.5-6.0	Low-----------	0.32			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cm^3	In/hr	In/in	pH					Pct
NnB2	0-8	12-30	1.20-1.40	0.6-2.0	0.19-0.23	4.5-6.5	Low	0.43	3	5	2-4
Nicholson	8-26	18-35	1.40-1.60	0.6-2.0	0.18-0.22	4.5-6.5	Low	0.43			
	26-42	18-35	1.50-1.70	0.06-0.2	0.07-0.12	4.5-6.5	Low	0.43			
	42-72	35-60	1.40-1.60	0.06-0.6	0.07-0.12	5.1-7.8	Moderate	0.37			
PeE	0-8	28-40	1.40-1.60	0.2-0.6	0.21-0.23	5.6-7.3	Moderate	0.37	3	7	1-4
Pate	8-50	35-55	1.50-1.70	<0.06	0.08-0.16	5.6-7.3	High	0.37			
	50-65	35-55	1.60-1.80	<0.06	0.05-0.12	6.1-8.4	High	0.37			
	65	---	---	---	---	---	---	---			
PkB	0-7	15-26	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low	0.43	4	5	1-3
Pekin	7-25	25-35	1.40-1.60	0.6-2.0	0.20-0.22	4.5-5.5	Low	0.43			
	25-57	22-30	1.60-1.80	<0.06	0.06-0.08	4.5-5.5	Low	0.43			
	57-60	20-34	1.40-1.60	0.6-2.0	0.06-0.08	4.5-7.3	Low	0.43			
Pu*. Pits											
Ra	0-10	22-34	1.30-1.45	0.6-2.0	0.21-0.23	6.1-7.3	Moderate	0.37	3	5	.5-2
Rahm	10-78	24-34	1.40-1.60	0.06-0.2	0.18-0.22	4.5-6.0	Moderate	0.37			
	78-80	30-42	1.40-1.60	0.06-0.2	0.13-0.18	4.5-6.0	Moderate	0.37			
RoA, RoB2	0-8	13-27	1.35-1.50	0.6-2.0	0.20-0.24	4.5-7.3	Low	0.37	4	6	1-3
Rossmoyne	8-25	22-35	1.40-1.60	0.6-2.0	0.14-0.19	4.5-5.5	Moderate	0.37			
	25-80	24-35	1.70-1.90	0.06-0.6	0.06-0.10	4.5-5.5	Moderate	0.37			
RyA, RyB2, RyC2, RyC3	0-6	15-27	1.35-1.50	0.6-2.0	0.22-0.24	5.1-7.3	Low	0.37	5	5	1-4
Ryker	6-67	20-35	1.40-1.60	0.6-2.0	0.18-0.22	4.5-7.3	Moderate	0.37			
	67-80	20-40	1.45-1.65	0.6-2.0	0.15-0.20	4.5-6.0	Moderate	0.37			
SwB2	0-11	20-27	1.30-1.50	0.6-2.0	0.22-0.24	5.1-7.3	Low	0.43	4	5	.5-3
Switzerland	11-26	25-35	1.40-1.65	0.6-2.0	0.18-0.22	4.5-6.0	Moderate	0.43			
	26-80	55-70	1.35-1.60	<0.06	0.09-0.13	4.5-8.4	High	0.32			
	80	---	---	---	---	---	---	---			
SxC2*:											
Switzerland	0-5	20-27	1.30-1.50	0.6-2.0	0.22-0.24	5.1-7.3	Low	0.43	4	5	.5-3
	5-25	25-35	1.40-1.65	0.6-2.0	0.18-0.22	4.5-6.0	Moderate	0.43			
	25-60	55-70	1.35-1.60	<0.06	0.09-0.13	4.5-8.4	High	0.32			
Carmel	0-5	20-27	1.30-1.50	0.6-2.0	0.22-0.24	5.1-7.3	Low	0.43	4	6	1-4
	5-17	25-40	1.40-1.60	0.6-2.0	0.18-0.20	5.1-6.5	Moderate	0.43			
	17-37	50-60	1.55-1.75	<0.06	0.09-0.11	4.5-6.5	High	0.32			
	37-48	40-55	1.55-1.75	<0.06	0.03-0.08	7.4-8.4	Moderate	0.32			
	48	---	---	---	---	---	---	---			
TrC2, TrD2	0-6	7-27	1.20-1.40	0.6-2.0	0.15-0.23	3.6-5.5	Low	0.37	3	5	1-3
Trappist	6-31	30-60	1.40-1.65	0.2-0.6	0.08-0.18	3.6-5.5	Moderate	0.28			
	31-38	35-60	1.40-1.60	0.06-0.2	0.05-0.12	3.6-5.5	Moderate	0.24			
	38	---	---	---	---	---	---	---			
TtC3, TtD3	0-8	27-40	1.20-1.40	0.6-2.0	0.15-0.23	3.6-5.5	Low	0.32	2	7	.5-2
Trappist	8-33	30-60	1.40-1.65	0.2-0.6	0.08-0.18	3.6-5.5	Moderate	0.28			
	33-39	35-60	1.40-1.60	0.06-0.2	0.05-0.12	3.6-5.5	Moderate	0.24			
	39	---	---	---	---	---	---	---			
Ud*. Udorthents											
Wt	0-15	10-18	1.30-1.45	0.6-2.0	0.17-0.20	6.1-7.3	Low	0.37	5	5	.5-3
Wirt	15-50	10-18	1.40-1.55	0.6-2.0	0.15-0.20	6.1-7.3	Low	0.24			
	50-60	8-18	1.45-1.60	2.0-6.0	0.14-0.17	6.6-7.3	Low	0.24			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
AvA, AvB2--------- Avonburg	D	None---------	---	---	1.0-3.0	Perched	Jan-Apr	>60	---	High-----	High-----	High.
BeD3*: Beasley----------	C	None---------	---	---	>6.0	---	---	40-60	Soft	Moderate	Moderate	Moderate.
Rock outcrop.												
BnC2, BnC3, BnD2, BnD3, BnE-------- Bonnell	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
CaF*: Caneyville--------	C	None---------	---	---	>6.0	---	---	20-40	Hard	Moderate	High-----	Moderate.
Rock outcrop.												
CcC2, CdC3--------- Carmel	C	None---------	---	---	>6.0	---	---	>40	Soft	Moderate	High-----	Moderate.
CnB2, CnC2, CnC3-- Cincinnati	C	None---------	---	---	>4.0	Perched	Jan-Apr	>60	---	High-----	Moderate	High.
Co----------------- Cobbsfork	D	None---------	---	---	+.5-1.0	Perched	Dec-Apr	>60	---	High-----	High-----	High.
CrB2--------------- Crider Variant	B	None---------	---	---	>6.0	---	---	40-60	Hard	High-----	Moderate	Moderate.
Da, Db------------- Dearborn	B	Frequent----	Very brief	Nov-Mar	>6.0	---	---	>60	---	Moderate	Low------	Low.
DeB2, DeC2, DeC3-- Deputy	C	None---------	---	---	1.5-3.0	Perched	Jan-Apr	40-60	Soft	Moderate	High-----	High.
Du*. Dumps												
EeD2, EfF---------- Eden	C	None---------	---	---	>6.0	---	---	20-40	Soft	Moderate	Moderate	Low.
EgG*: Eden--------------	C	None---------	---	---	>6.0	---	---	20-40	Soft	Moderate	Moderate	Low.
Caneyville--------	C	None---------	---	---	>6.0	---	---	20-40	Hard	Moderate	High-----	Moderate.
EkA, EkB----------- Elkinsville	B	Rare---------	---	---	>6.0	---	---	>60	---	High-----	Moderate	High.

See footnote at end of table.

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
GrC2, GrC3, GrD2, GrD3--------------- Grayford	B	None---------	---	---	>6.0	---	---	40-60	Hard	High------	High------	Moderate.
Ha------------------ Haymond	B	Occasional	Brief------	Jan-May	>6.0	---	---	>60	---	High------	Low--------	Low.
HkC2, HkC3, HkD2, HkD3, HkE--------- Hickory	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Ho------------------ Holton	C	Occasional	Brief------	Nov-Jun	1.0-3.0	Apparent	Nov-Jun	>60	---	High------	Moderate	High.
Hu------------------ Huntington	B	Occasional	Brief------	Dec-May	4.0-6.0	Apparent	Dec-Apr	>60	---	High------	Low--------	Moderate.
JnB2, JnC2, JnC3--- Jennings	C	None---------	---	---	2.0-3.0	Perched	Feb-May	>60	---	High------	High------	High.
MaB2, MaC2--------- Markland	C	None---------	---	---	3.0-6.0	Perched	Mar-Apr	>60	---	Moderate	High------	Moderate.
NeB2, NeC2--------- Negley	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low--------	High.
NnB2--------------- Nicholson	C	None---------	---	---	1.5-2.5	Perched	Jan-Apr	>60	---	Moderate	High------	Moderate.
PeE---------------- Pate	C	None---------	---	---	>6.0	---	---	>50	Soft	Moderate	High------	Moderate.
PkB---------------- Pekin	C	Rare---------	---	---	2.0-6.0	Apparent	Mar-Apr	>60	---	High------	Moderate	High.
Pu*. Pits												
Ra----------------- Rahm	C	Occasional	Brief------	Nov-Jun	1.0-3.0	Apparent	Nov-May	>60	---	High------	High------	High.
RoA, RoB2---------- Rossmoyne	C	None---------	---	---	1.5-3.0	Perched	Jan-Apr	>60	---	High------	High------	High.
RyA, RyB2, RyC2, RyC3-------------- Ryker	B	None---------	---	---	>6.0	---	---	>60	---	High------	Moderate	Moderate.
SwB2--------------- Switzerland	B	None---------	---	---	>6.0	---	---	>60	---	High------	Moderate	High.
SxC2*: Switzerland-------	B	None---------	---	---	>6.0	---	---	>60	---	High------	Moderate	High.

See footnote at end of table.

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro- logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
SxC2*:												
Carmel------------	C	None---------	---	---	>6.0	---	---	>40	Soft	Moderate	High-----	Moderate.
TrC2, TrD2, TtC3, TtD3------------- Trappist	C	None---------	---	---	>6.0	---	---	20-40	Hard	Moderate	High-----	High.
Ud*. Udorthents												
Wt---------------- Wirt	B	Occasional	Brief-----	Nov-Jun	>6.0	---	---	>60	---	Moderate	Low------	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 20.--CLASSIFICATION OF THE SOILS

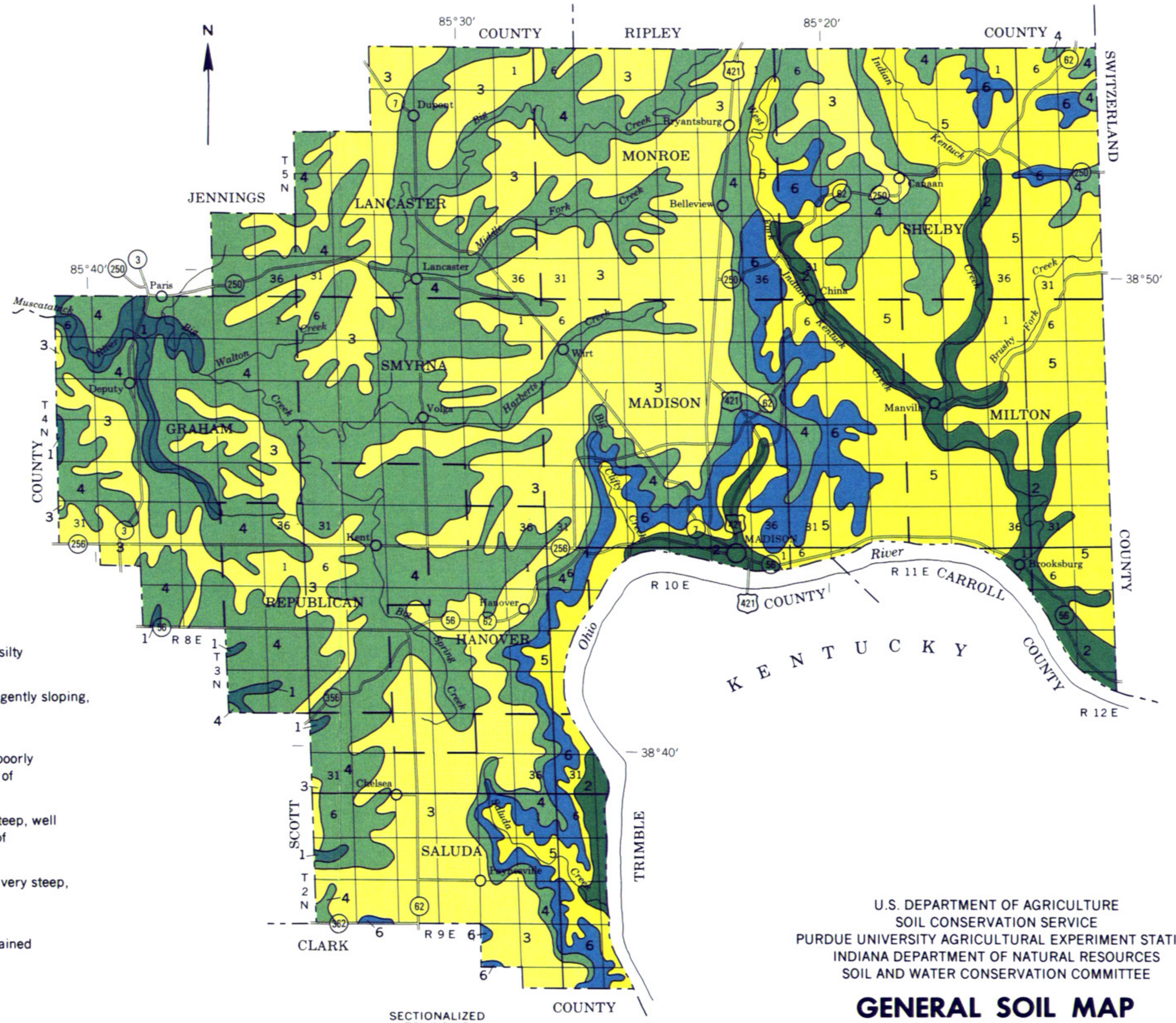
[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Avonburg	Fine-silty, mixed, mesic Aeric Fragiaqualfs
Beasley	Fine, mixed, mesic Typic Hapludalfs
Bonnell	Fine, mixed, mesic Typic Hapludalfs
Caneyville	Fine, mixed, mesic Typic Hapludalfs
Carmel	Fine, vermiculitic, mesic Typic Hapludalfs
Cincinnati	Fine-silty, mixed, mesic Typic Fragiudalfs
Cobbsfork	Fine-silty, mixed, mesic Typic Ochraqualfs
Crider Variant	Fine-silty over clayey, mixed, mesic Typic Hapludalfs
Dearborn	Loamy-skeletal, mixed, mesic Fluventic Hapludolls
Deputy	Fine-silty, mixed, mesic Aquic Hapludults
Eden	Fine, mixed, mesic Typic Hapludalfs
Elkinsville	Fine-silty, mixed, mesic Ultic Hapludalfs
Grayford	Fine-loamy, mixed, mesic Ultic Hapludalfs
Haymond	Coarse-silty, mixed, nonacid, mesic Typic Udifluvents
Hickory	Fine-loamy, mixed, mesic Typic Hapludalfs
Holton	Coarse-loamy, mixed, nonacid, mesic Aeric Fluvaquents
Huntington	Fine-silty, mixed, mesic Fluventic Hapludolls
Jennings	Fine-silty, mixed, mesic Typic Fragiudults
Markland	Fine, mixed, mesic Typic Hapludalfs
Negley	Fine-loamy, mixed, mesic Typic Paleudalfs
Nicholson	Fine-silty, mixed, mesic Typic Fragiudalfs
Pate	Fine, illitic, mesic Typic Hapludalfs
Pekin	Fine-silty, mixed, mesic Aquic Fragiudalfs
Rahm	Fine-silty, mixed, nonacid, mesic Aeric Fluvaquents
Rossmoyne	Fine-silty, mixed, mesic Aquic Fragiudalfs
Ryker	Fine-silty, mixed, mesic Typic Paleudalfs
Switzerland	Fine-silty over clayey, mixed, mesic Typic Hapludalfs
Trappist	Clayey, mixed, mesic Typic Hapludults
Udorthents	Loamy, mixed, mesic Udorthents
Wirt	Coarse-loamy, mixed, nonacid, mesic Typic Udifluvents

☆ U.S. GOVERNMENT PRINTING OFFICE : 1985 O - 451-139

NRCS Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.



LEGEND

1	WIRT-HAYMOND: Deep, nearly level, well drained soils formed in silty and loamy alluvium; on bottom land
2	HUNTINGTON-DEARBORN-ELKINSVILLE: Deep, nearly level and gently sloping, well drained soils formed in alluvium or in silty and loamy material; on bottom land and terraces
3	COBBSFORK-AVONBURG: Deep, nearly level and gently sloping, poorly drained and somewhat poorly drained soils formed in a thin mantle of loess and in the underlying glacial drift; on uplands
4	CINCINNATI-ROSSMOYNE-HICKORY: Deep, nearly level to very steep, well drained and moderately well drained soils formed in a thin mantle of loess and in the underlying glacial drift; on uplands
5	EDEN-CARMEL: Moderately deep and deep, moderately sloping to very steep, well drained soils formed in a thin mantle of loess and in material weathered from interbedded limestone and shale; on uplands
6	RYKER-GRAYFORD: Deep, nearly level to strongly sloping, well drained soils formed in a thin mantle of loess and in the underlying glacial drift and limestone residuum; on uplands

Compiled 1984

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION
INDIANA DEPARTMENT OF NATURAL RESOURCES
SOIL AND WATER CONSERVATION COMMITTEE

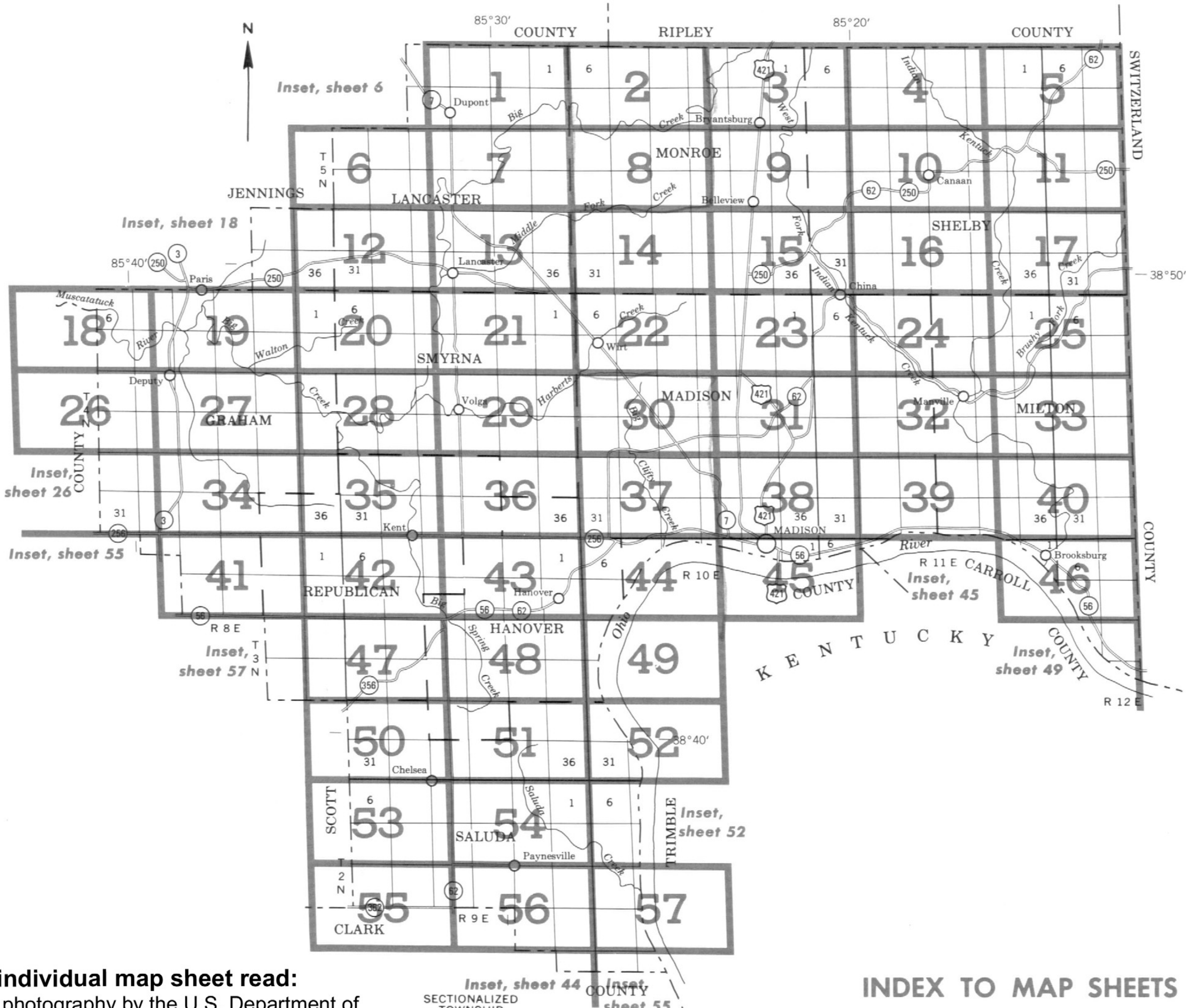
GENERAL SOIL MAP
JEFFERSON COUNTY, INDIANA

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



Original text from each individual map sheet read:
This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INDEX TO MAP SHEETS
JEFFERSON COUNTY, INDIANA

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km

SOIL LEGEND

Map symbols consist of a combination of letters or of letters and a number. The first capital letter is the initial one of the map unit name. The lowercase letter that follows separates map units having names that begin with the same letter, except that it does not separate sloping or eroded phases. The second capital letter indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas. A final number of 2 indicates that the soil is eroded and 3 that it is severely eroded.

SYMBOL	NAME
AvA	Avonburg silt loam, 0 to 2 percent slopes
AvB2	Avonburg silt loam, 2 to 4 percent slopes, eroded
BeD3	Beasley-Rock outcrop complex, 12 to 25 percent slopes, severely eroded
BnC2	Bonnell silt loam, 6 to 12 percent slopes, eroded
BnC3	Bonnell silt loam, 6 to 12 percent slopes, severely eroded
BnD2	Bonnell silt loam, 12 to 18 percent slopes, eroded
BnD3	Bonnell silt loam, 12 to 18 percent slopes, severely eroded
BnE	Bonnell silt loam, 18 to 45 percent slopes
CaF	Caneyville-Rock outcrop complex, 25 to 60 percent slopes
CcC2	Carmel silt loam, 6 to 12 percent slopes, eroded
CdC3	Carmel silty clay loam, 6 to 12 percent slopes, severely eroded
CnB2	Cincinnati silt loam, 2 to 6 percent slopes, eroded
CnC2	Cincinnati silt loam, 6 to 12 percent slopes, eroded
CnC3	Cincinnati silt loam, 6 to 12 percent slopes, severely eroded
Co	Cobbsfork silt loam
CrB2	Crider Variant silt loam, 2 to 6 percent slopes, eroded
Da	Dearborn silt loam, frequently flooded
Db	Dearborn channery silt loam, frequently flooded
DeB2	Deputy silt loam, 2 to 6 percent slopes, eroded
DeC2	Deputy silt loam, 6 to 12 percent slopes, eroded
DeC3	Deputy silt loam, 6 to 12 percent slopes, severely eroded
Du	Dumps
EeD2	Eden silty clay loam, 12 to 25 percent slopes, eroded
EfF	Eden flaggy silty clay loam, 25 to 50 percent slopes
EgG	Eden-Caneyville complex, 25 to 60 percent slopes
EkA	Elkinsville silt loam, 0 to 2 percent slopes, rarely flooded
EkB	Elkinsville silt loam, 2 to 8 percent slopes, rarely flooded
GrC2	Grayford silt loam, 6 to 12 percent slopes, eroded
GrC3	Grayford silt loam, 6 to 12 percent slopes, severely eroded
GrD2	Grayford silt loam, 12 to 18 percent slopes, eroded
GrD3	Grayford silt loam, 12 to 18 percent slopes, severely eroded
Ha	Haymond silt loam, occasionally flooded
HkC2	Hickory silt loam, 6 to 12 percent slopes, eroded
HkC3	Hickory silt loam, 6 to 12 percent slopes, severely eroded
HkD2	Hickory silt loam, 12 to 18 percent slopes, eroded
HkD3	Hickory silt loam, 12 to 18 percent slopes, severely eroded
HkE	Hickory silt loam, 18 to 45 percent slopes
Ho	Holton loam, occasionally flooded
Hu	Huntington silt loam, occasionally flooded
JnB2	Jennings silt loam, 2 to 6 percent slopes, eroded
JnC2	Jennings silt loam, 6 to 12 percent slopes, eroded
JnC3	Jennings silt loam, 6 to 12 percent slopes, severely eroded
MaB2	Markland silt loam, 1 to 6 percent slopes, eroded
MaC2	Markland silt loam, 8 to 15 percent slopes, eroded
NeB2	Negley silt loam, 2 to 6 percent slopes, eroded
NeC2	Negley silt loam, 6 to 12 percent slopes, eroded
NnB2	Nicholson silt loam, 2 to 6 percent slopes, eroded
PeE	Pate silty clay loam, 18 to 35 percent slopes
PkB	Pekin silt loam, 1 to 4 percent slopes, rarely flooded
Pu	Pits, quarries
Ra	Rahm silty clay loam, occasionally flooded
RoA	Rossmoyne silt loam, 0 to 2 percent slopes
RoB2	Rossmoyne silt loam, 2 to 6 percent slopes, eroded
RyA	Ryker silt loam, 0 to 2 percent slopes
RyB2	Ryker silt loam, 2 to 6 percent slopes, eroded
RyC2	Ryker silt loam, 6 to 12 percent slopes, eroded
RyC3	Ryker silt loam, 6 to 12 percent slopes, severely eroded
SwB2	Switzerland silt loam, 2 to 6 percent slopes, eroded
SxC2	Switzerland-Carmel silt loams, 2 to 12 percent slopes, eroded
TrC2	Trappist silt loam, 6 to 12 percent slopes, eroded
TrD2	Trappist silt loam, 12 to 18 percent slopes, eroded
TtC3	Trappist silty clay loam, 6 to 12 percent slopes, severely eroded
TtD3	Trappist silty clay loam, 12 to 25 percent slopes, severely eroded
Ud	Udorthents, loamy
Wt	Wirt silt loam, occasionally flooded

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool — Davis Airstrip; FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate — 79
- Federal — 410
- State — 52
- County, farm or ranch — 378

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water; w

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — GAS
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water; w
- Intermittent — int; i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — AvA RyB2

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

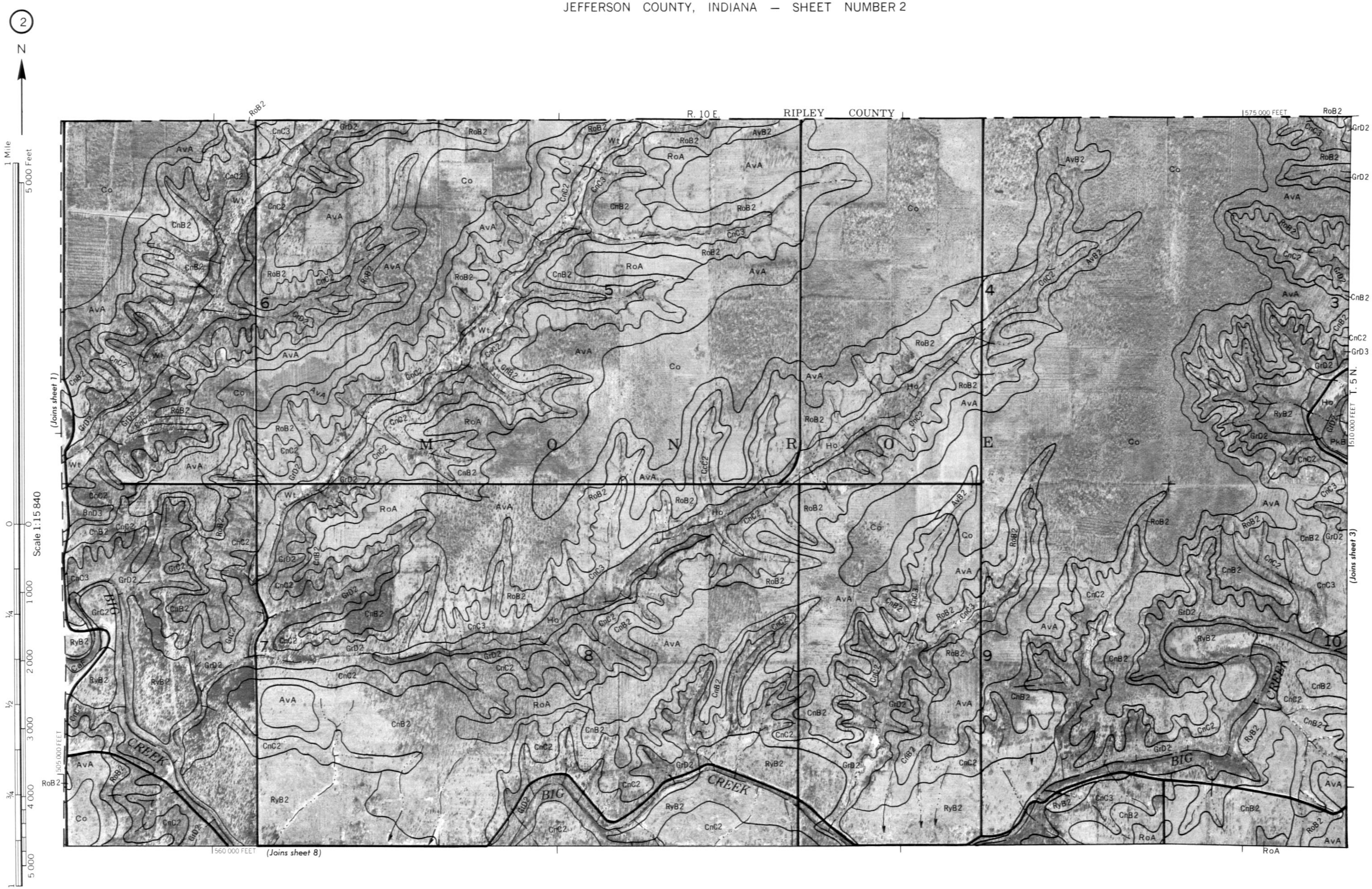
SOIL SAMPLE SITE (normally not shown) — S

MISCELLANEOUS

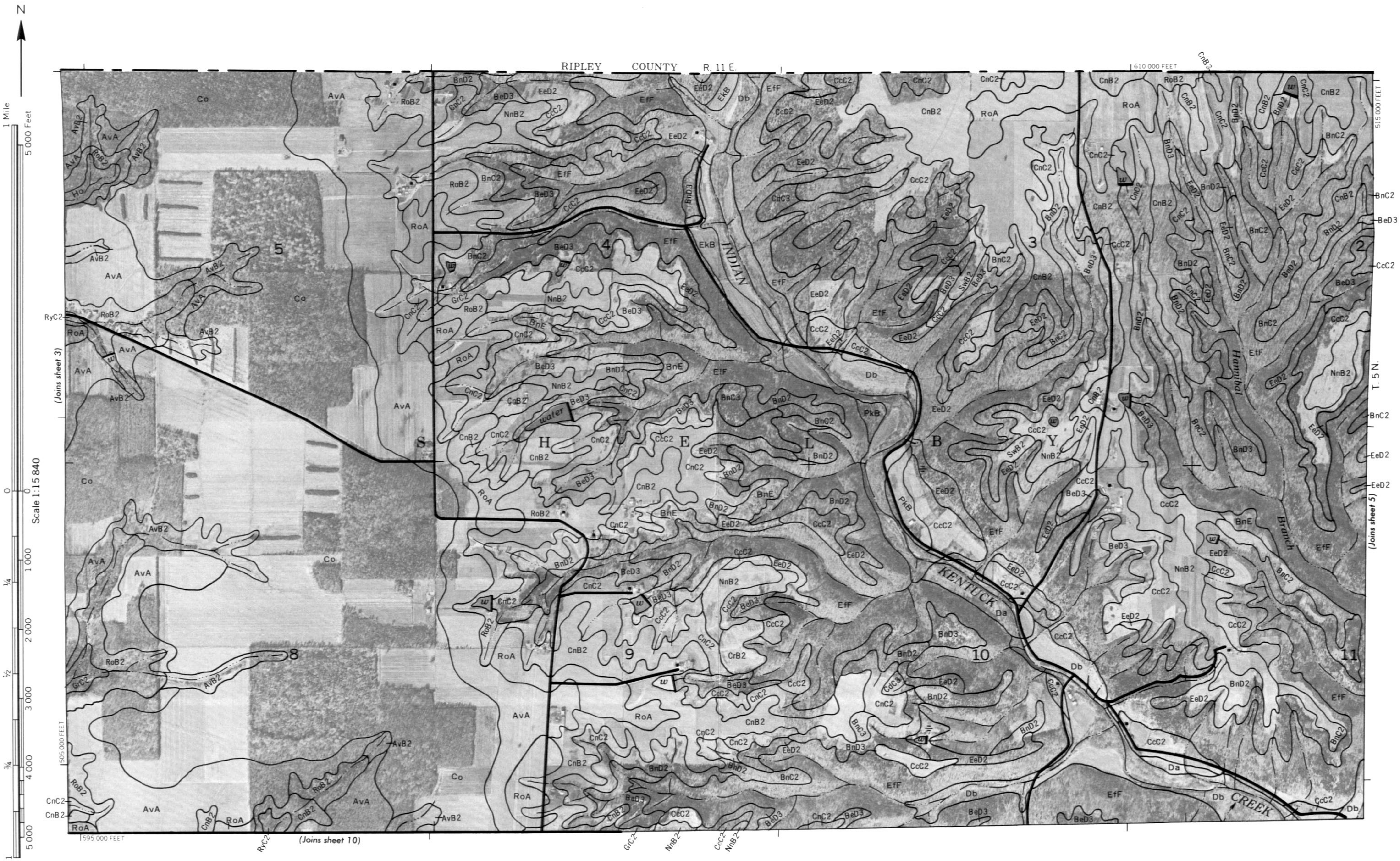
- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Small pit
- Sanitary land fill

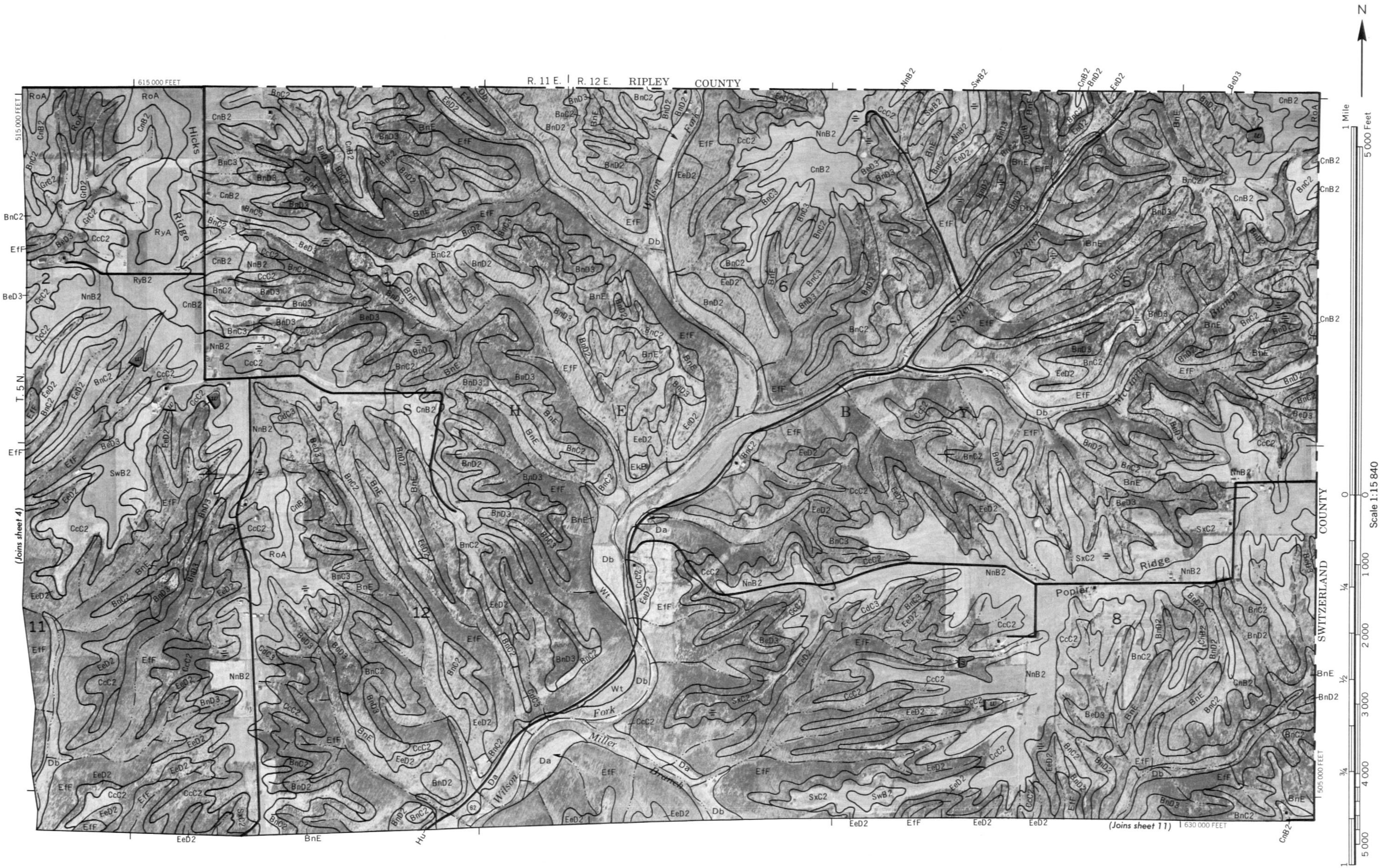

1
N
JENNINGS COUNTY
R. 9 E.
540 000 FEET
510 000 FEET
T. 5 N.
505 000 FEET
555 000 FEET
L A N C A S T E R
Camp Creek
BIG CREEK
Dupont
(Joins sheet 2)
(Joins inset, sheet 6)
(Joins sheet 7)
Scale 1:15 840
1 Mile
5 000 Feet
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000

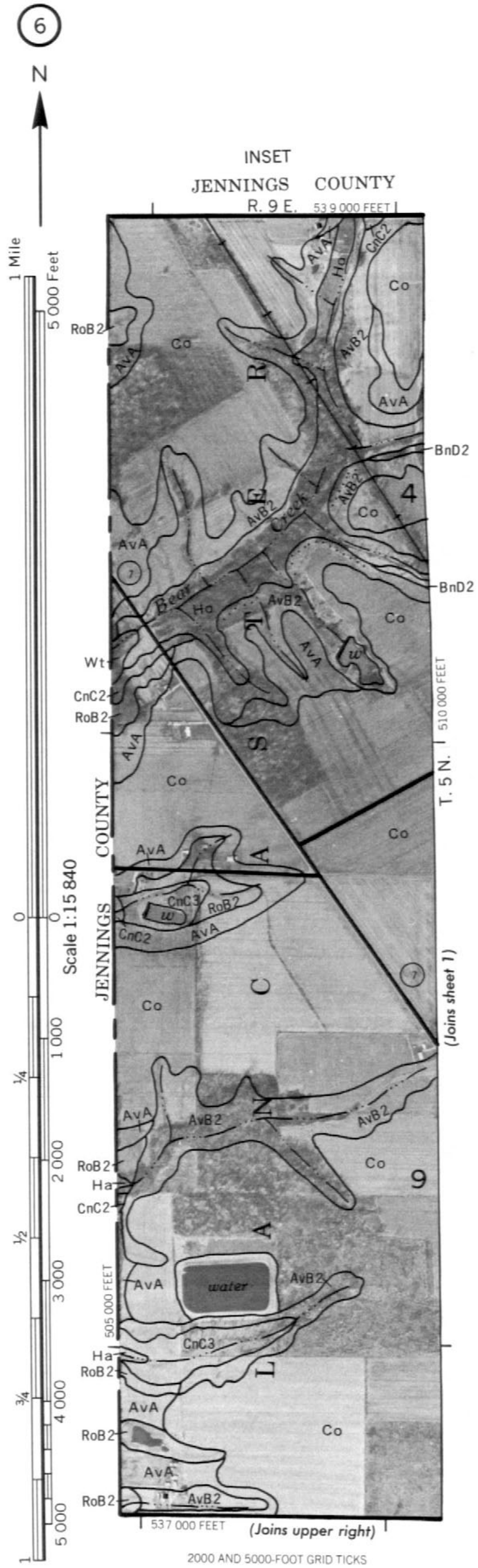
JEFFERSON COUNTY, INDIANA — SHEET NUMBER 2

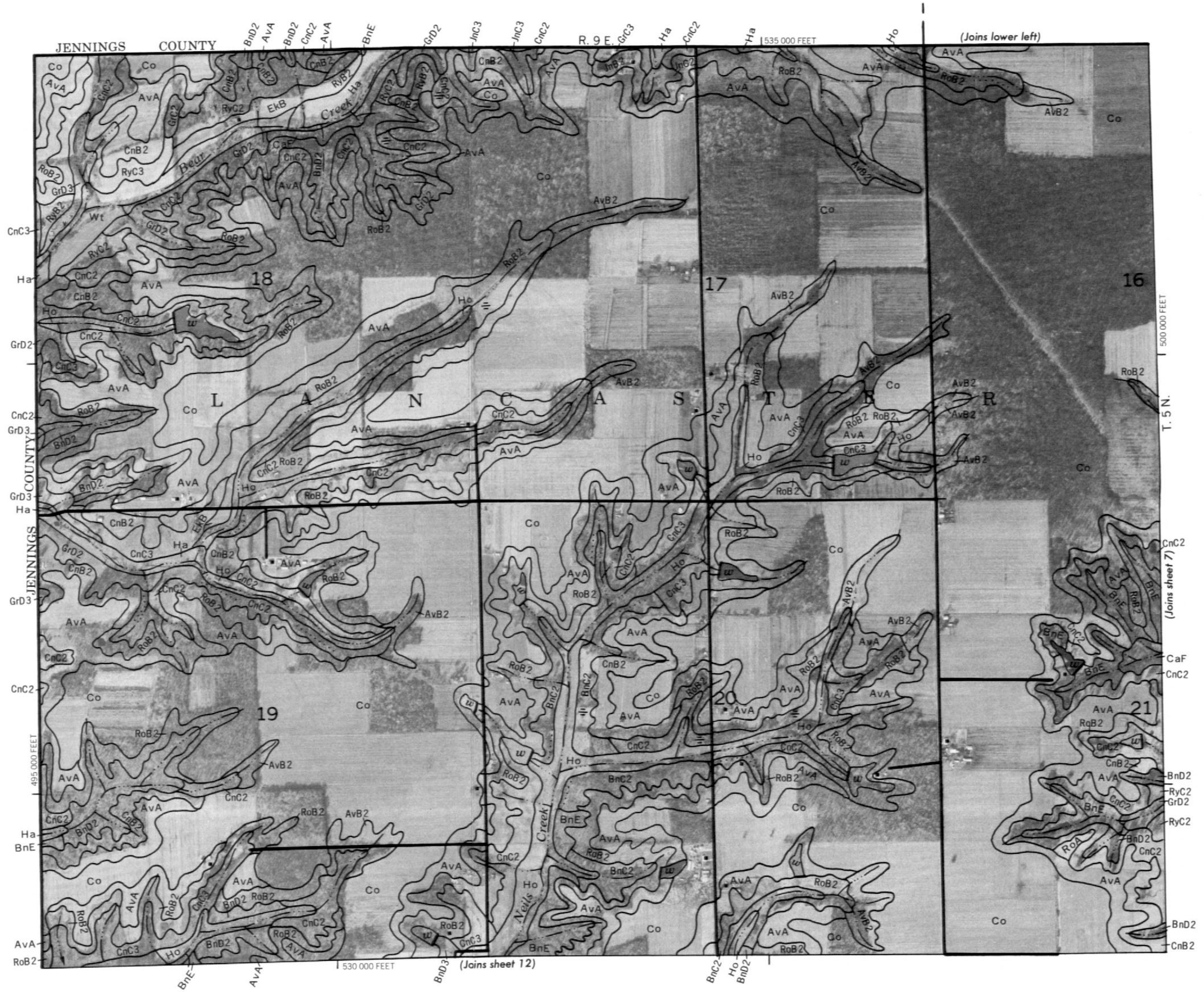


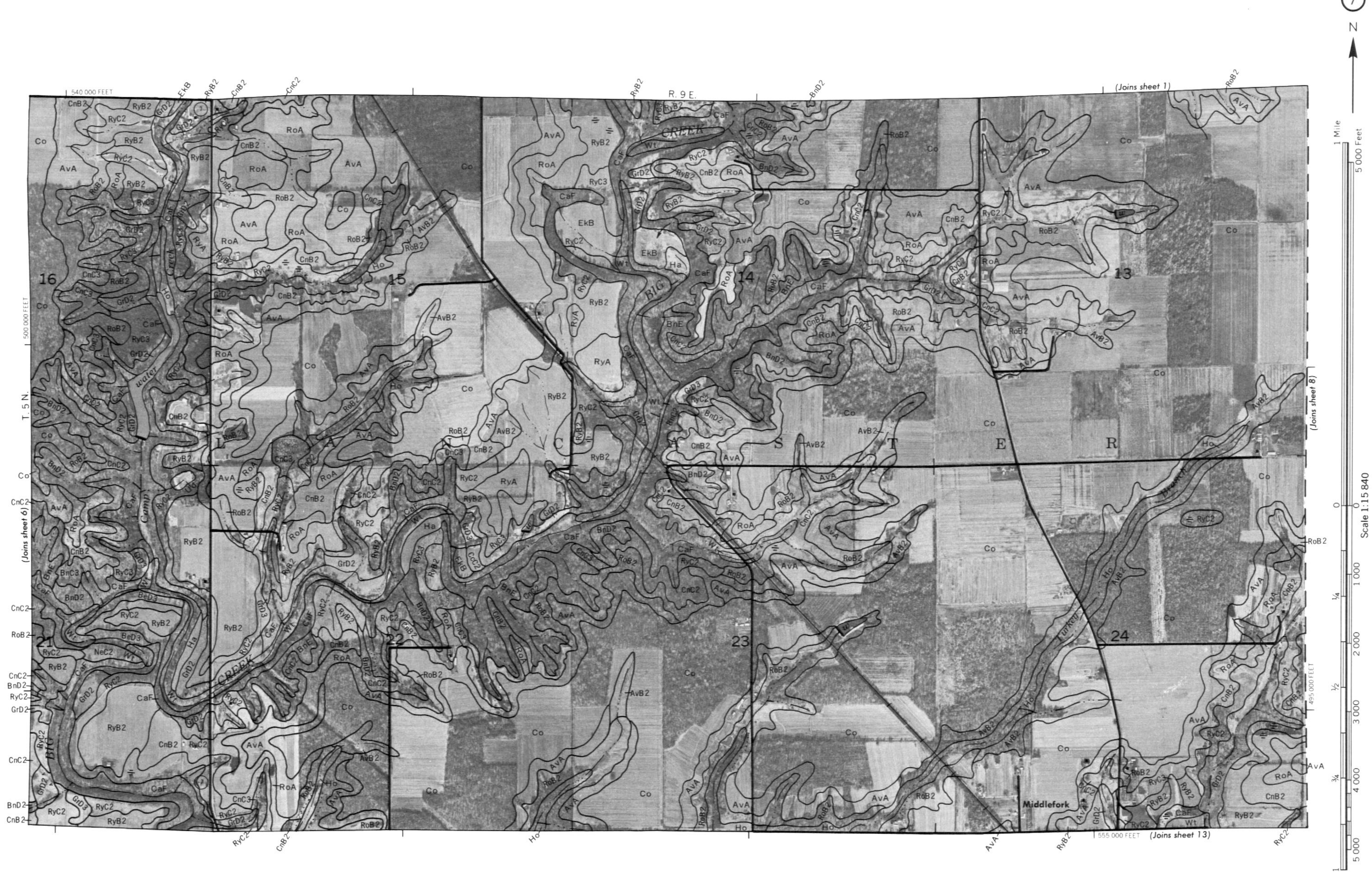

N
RIPLEY COUNTY
R. 10 E. | R. 11 E.
T. 5 N.
580 000 FEET
590 000 FEET
510 000 FEET
505 000 FEET
BIG CREEK
INDIAN CREEK
JEFFERSON PROVING GROUND
MONROE
SHELBY
WEST FORK KENTUCKY
Bryantsburg
(Joins sheet 2)
(Joins sheet 4)
(Joins sheet 9)
1 Mile
5 000 Feet
Scale 1:15 840
0
¼
½
¾
1
1 000
2 000
3 000
4 000
5 000

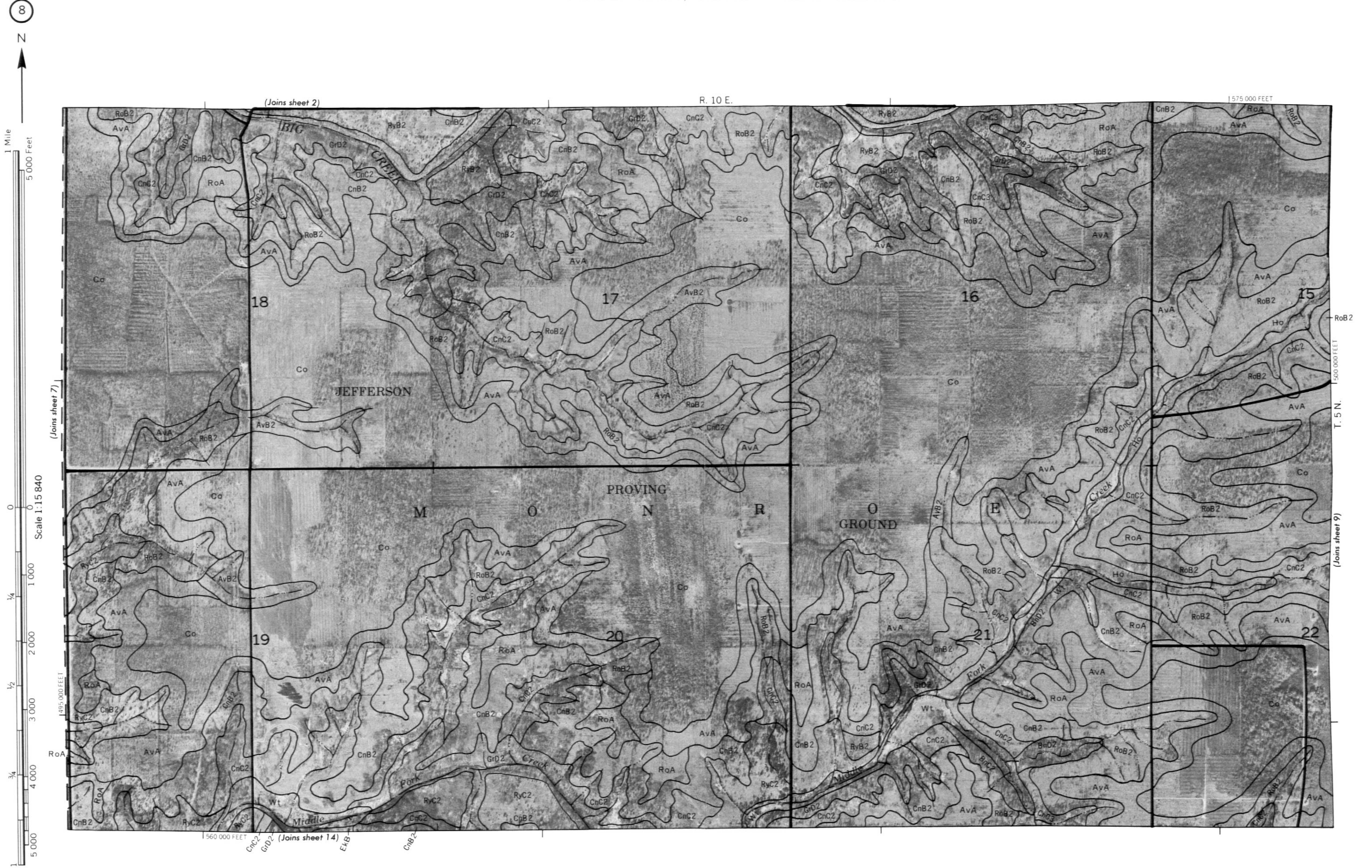

4
N
1 Mile
5 000 Feet
Scale 1:15 840
RIPLEY COUNTY
R. 11 E.
610 000 FEET
515 000 FEET
505 000 FEET
595 000 FEET
T. 5 N.
(Joins sheet 3)
(Joins sheet 5)
(Joins sheet 10)
INDIAN
KENTUCK
CREEK
Hannibal
Branch
S H E L B Y
water
5
4
3
2
8
9
10
11


N
615 000 FEET
R. 11 E.
R. 12 E.
RIPLEY COUNTY
515 000 FEET
T. 5 N.
(Joins sheet 4)
Hicks Ridge
Wilson Fork
Salem Branch
McClure Branch
Miller Branch
Poplar Ridge
SHELBY
SWITZERLAND COUNTY
(Joins sheet 11)
630 000 FEET
505 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1
2
5
6
7
8
11
12


6
N
INSET
JENNINGS COUNTY
R. 9 E.
539 000 FEET
T. 5 N.
510 000 FEET
505 000 FEET
537 000 FEET
(Joins sheet 1)
(Joins upper right)
Scale 1:15 840
1 Mile
5 000 Feet
2000 AND 5000-FOOT GRID TICKS
Bear Creek
water
4
9


JENNINGS COUNTY
R. 9 E.
535 000 FEET
(Joins lower left)
500 000 FEET
T. 5 N.
(Joins sheet 7)
495 000 FEET
530 000 FEET
(Joins sheet 12)
L A N C A S T E R
Bear Creek
Neils Creek
16
17
18
19
20
21



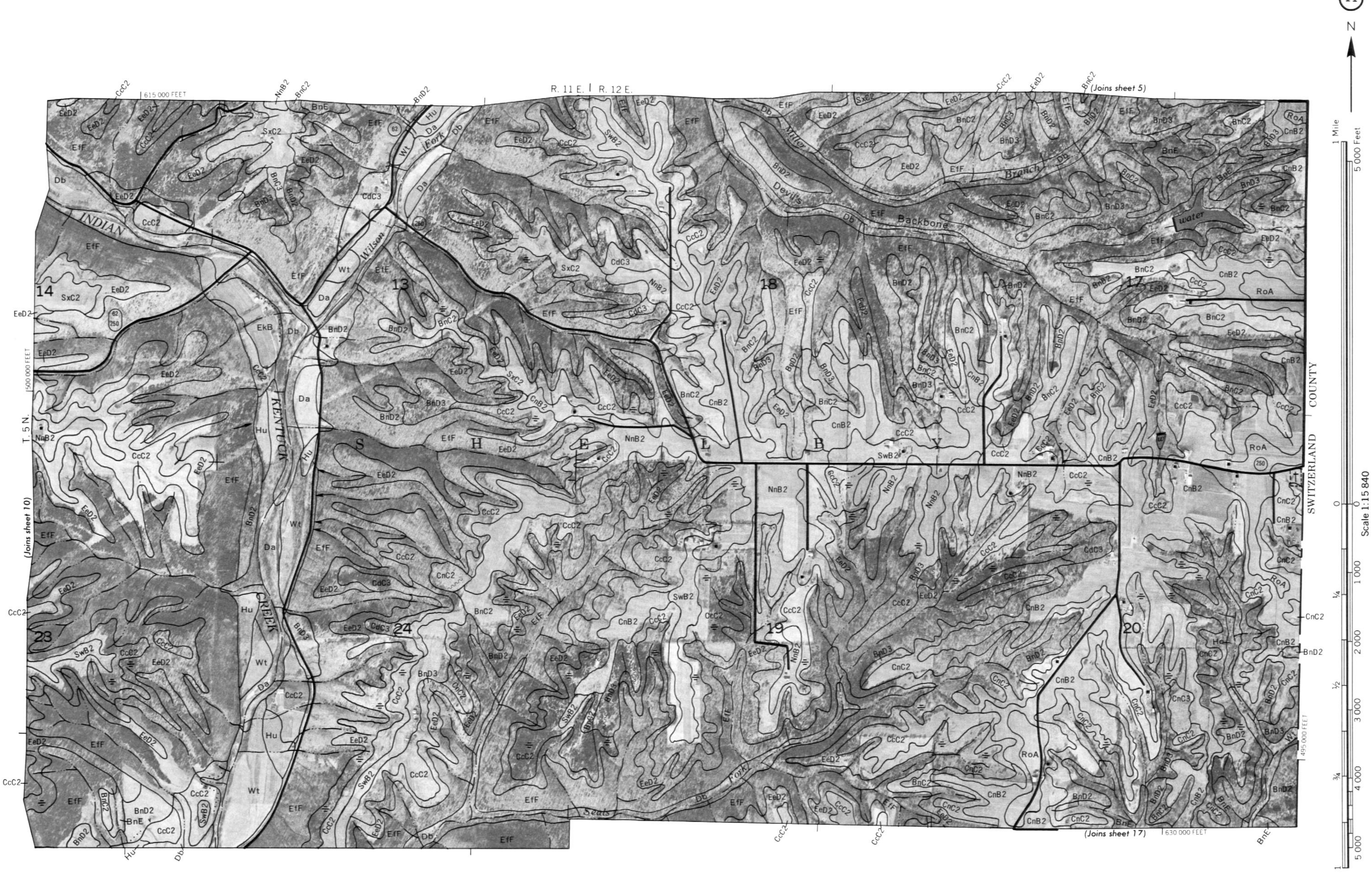


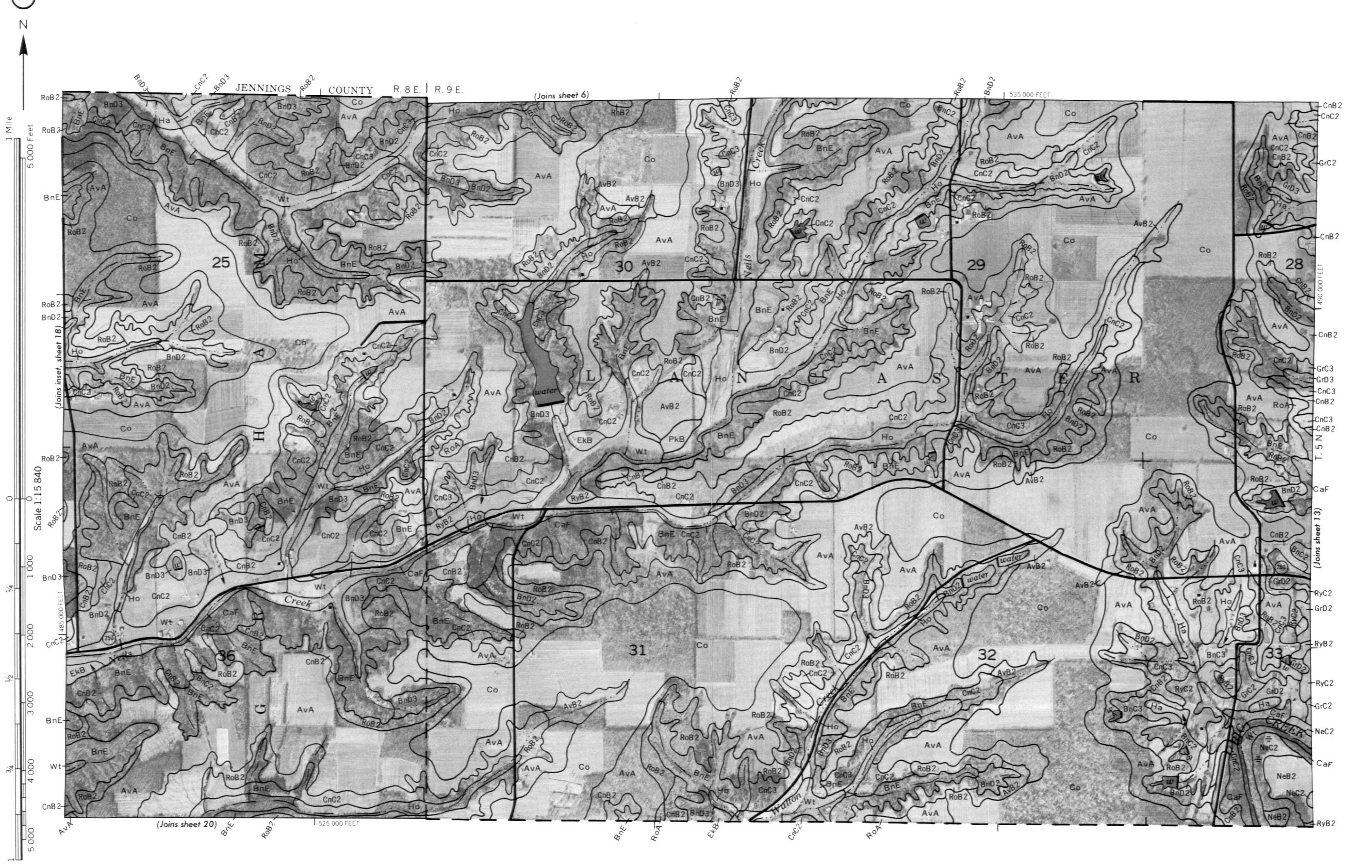
8
N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 2)
R. 10 E.
575 000 FEET
(Joins sheet 7)
(Joins sheet 9)
(Joins sheet 14)
T. 5 N.
500 000 FEET
495 000 FEET
560 000 FEET
BIG CREEK
JEFFERSON
PROVING
GROUND
M O N R O E
Middle Fork Creek
18
17
16
15
19
20
21
22

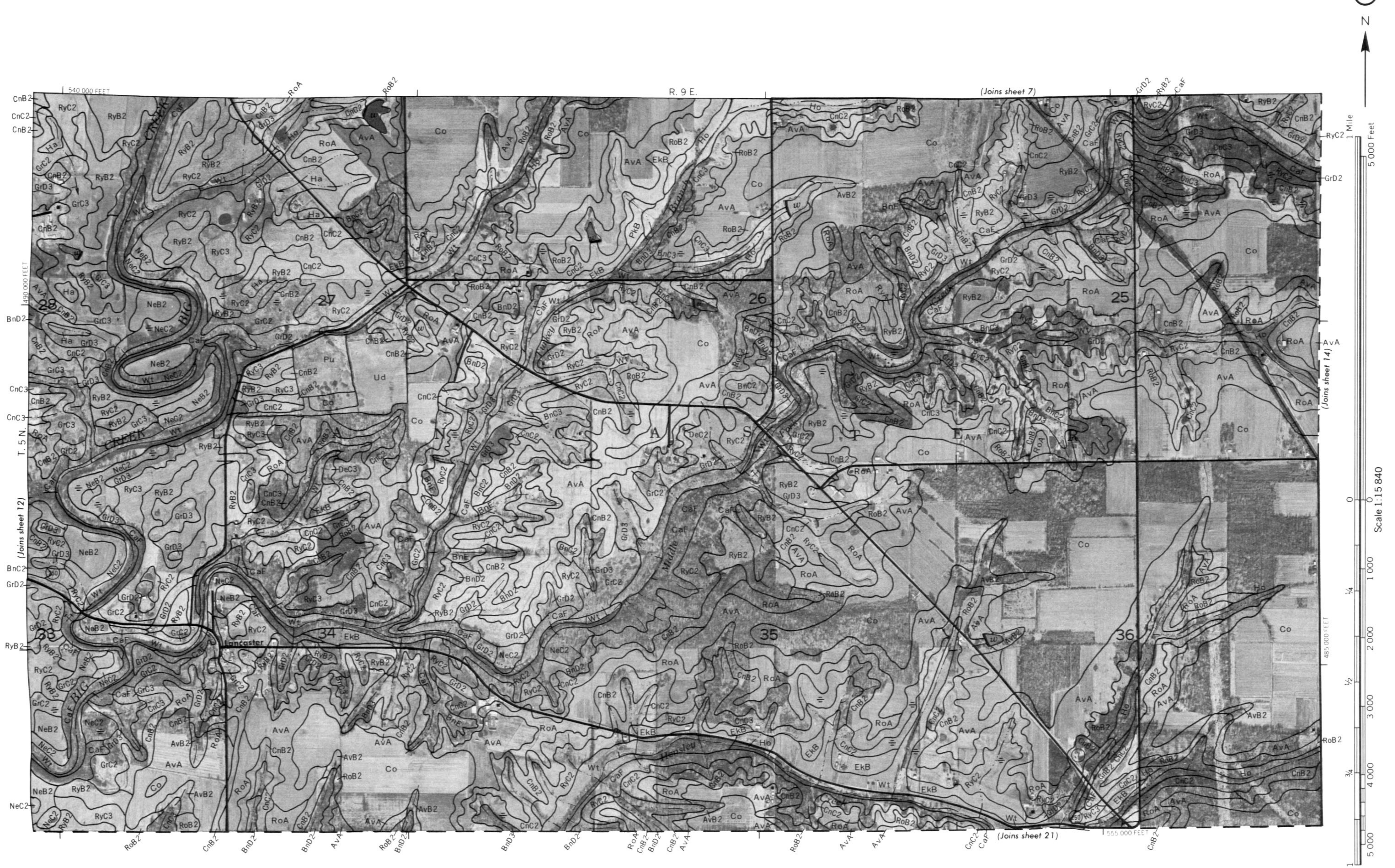

9
N
580 000 FEET
R. 10 E.
R. 11 E
(Joins sheet 3)
(Joins sheet 8)
(Joins sheet 10)
(Joins sheet 15)
T. 5 N.
500 000 FEET
495 000 FEET
590 000 FEET
Bryantsburg
Belleview
421
JEFFERSON
PROVING
GROUND
M O N R O E
S H E L B Y
COPELAND RIDGE
WEST FORK INDIAN KENTUCK CREEK
Daddys Branch
13
14
15
18
19
22
23
24
1 Mile
5 000 Feet
Scale 1:15 840

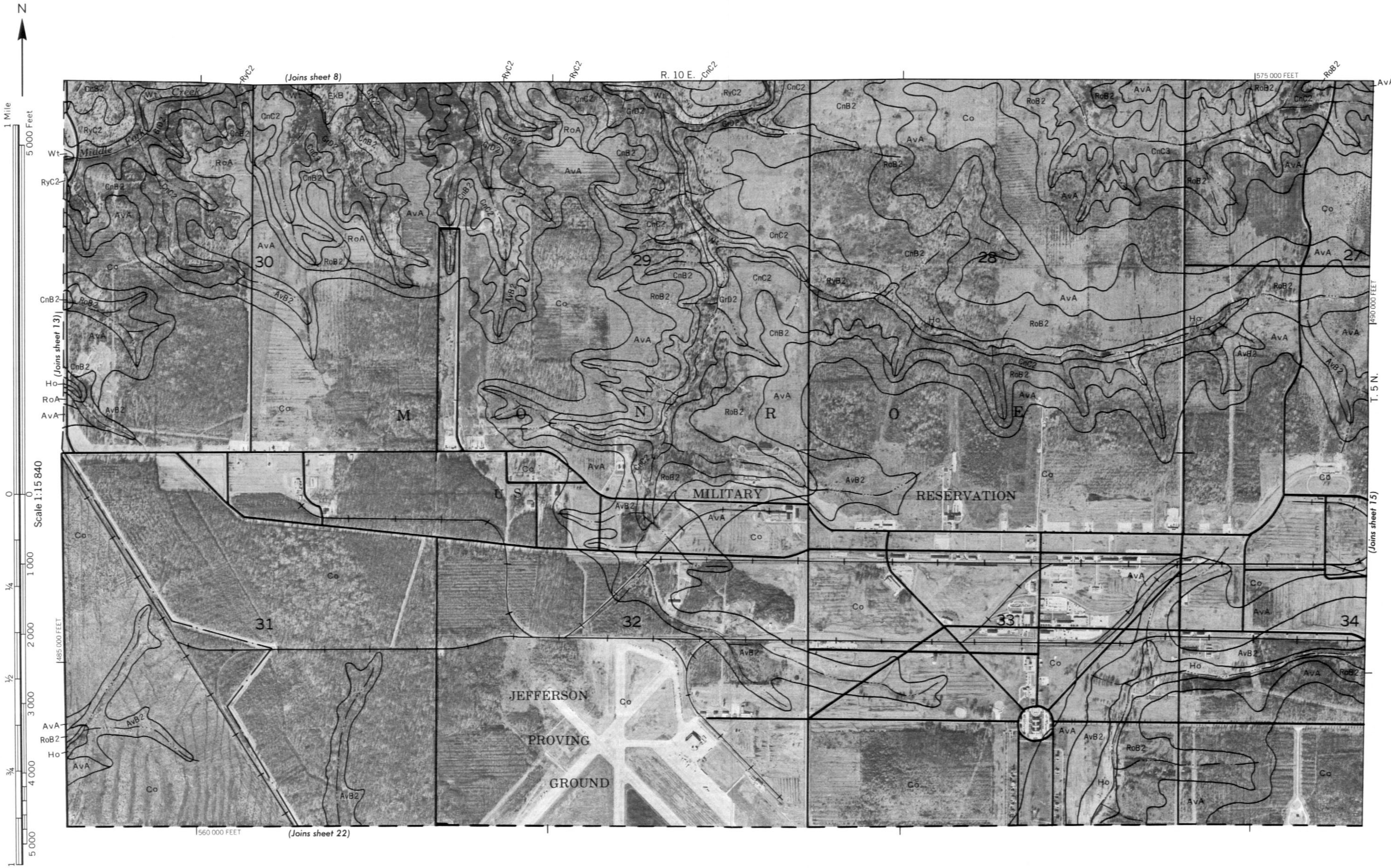

10
N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 4)
(Joins sheet 9)
(Joins sheet 11)
(Joins sheet 16)
R. 11 E.
T. 5 N.
610 000 FEET
500 000 FEET
495 000 FEET
595 000 FEET
COPELAND
RIDGE
Canaan
White
Eye
Hollow
Toddy's
Branch
14
15
16
17
20
21
22
23

JEFFERSON COUNTY, INDIANA — SHEET NUMBER 11

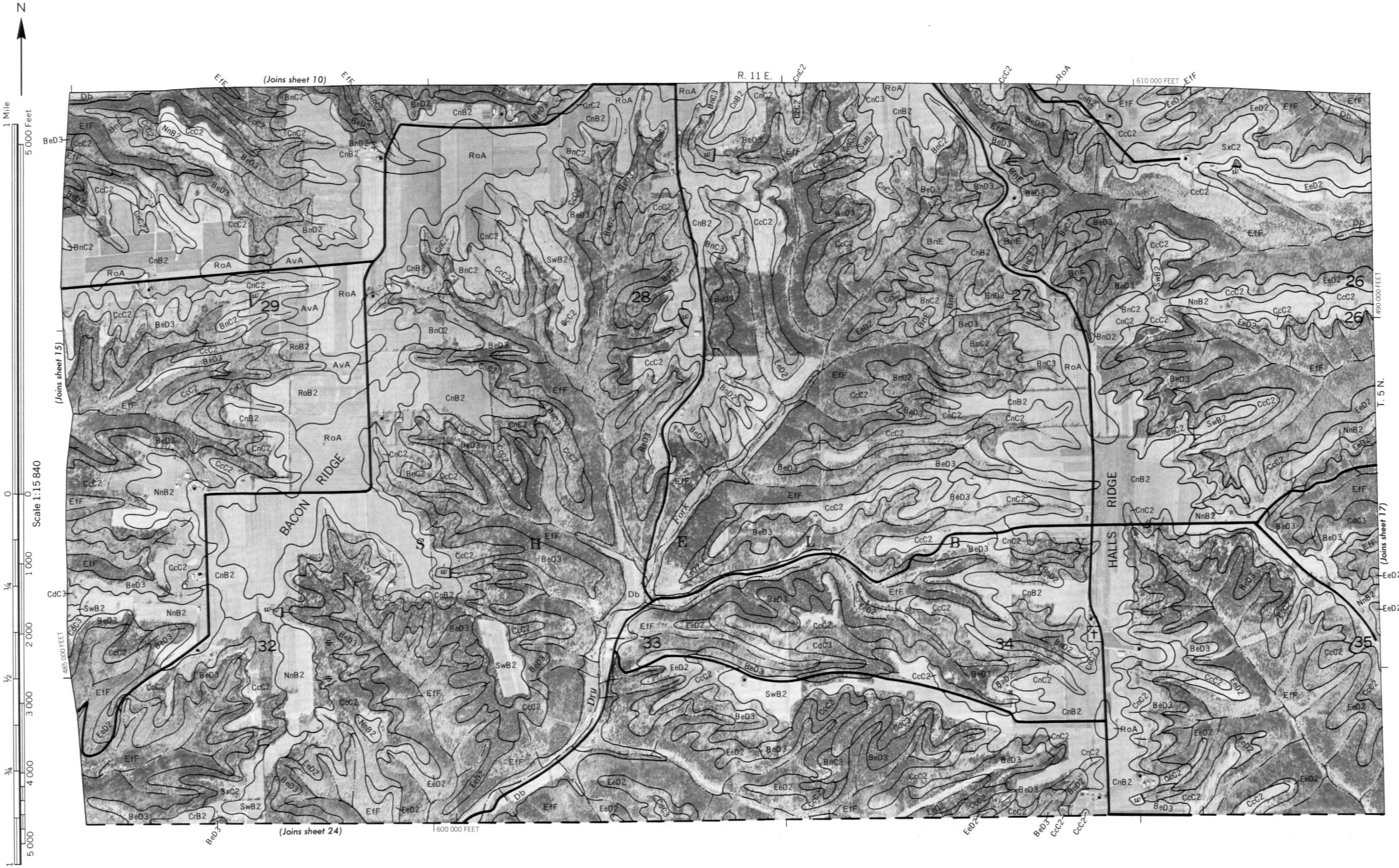



12
N
JENNINGS COUNTY
R. 8 E.
R. 9 E.
(Joins sheet 6)
535 000 FEET
490 000 FEET
(Joins inset, sheet 18)
(Joins sheet 13)
(Joins sheet 20)
525 000 FEET
485 000 FEET
T. 5 N.
HAMILTON
LANCASTER
GRAHAM
Nells Creek
Walton Creek
Big Creek
water
25
30
29
28
36
31
32
33
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1


13
N
540 000 FEET
R. 9 E.
(Joins sheet 7)
490 000 FEET
T. 5 N.
(Joins sheet 12)
(Joins sheet 14)
(Joins sheet 21)
485 000 FEET
555 000 FEET
Lancaster
BIG CREEK
Middle Fork
Turkey Branch
Hensley
L A N C A S T E R
27
26
25
28
33
34
35
36
1 Mile
5 000 Feet
Scale 1:15 840
0
¼
½
¾
1000
2000
3000
4000
5000


N
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
(Joins sheet 8)
(Joins sheet 13)
(Joins sheet 15)
(Joins sheet 22)
R. 10 E.
T. 5 N.
575 000 FEET
490 000 FEET
485 000 FEET
560 000 FEET
Middle Fork
Creek
30
29
28
27
31
32
33
34
U S
M O N R O E
MILITARY
RESERVATION
JEFFERSON
PROVING
GROUND
Co
AvA
AvB2
RoA
RoB2
CnB2
CnC2
CnC3
RyC2
RyB2
GrD2
GrB2
EkB
Wt
Ho

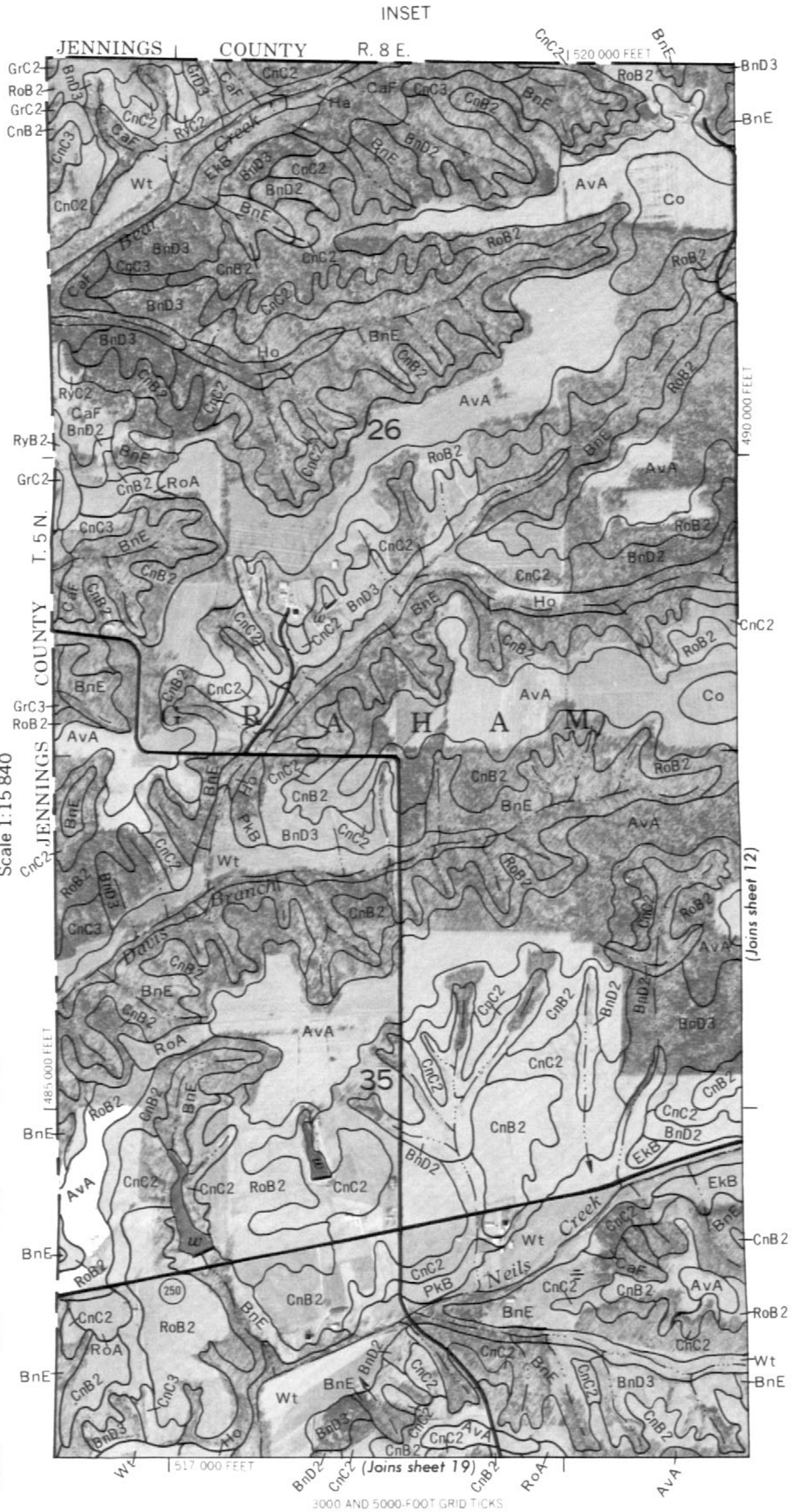

15
N
(Joins sheet 9)
(Joins sheet 14)
(Joins sheet 16)
(Joins sheet 23)
580 000 FEET
490 000 FEET
485 000 FEET
595 000 FEET
R. 10 E.
R. 11 E.
T. 5 N.
JEFFERSON
PROVING
GROUND
M O N R O E
S H E L B Y
WEST FORK
INDIAN KENTUCK CREEK
Branch
China
water
27
26
25
30
34
35
36
31
1 Mile
5 000 Feet
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000
Scale 1:15 840

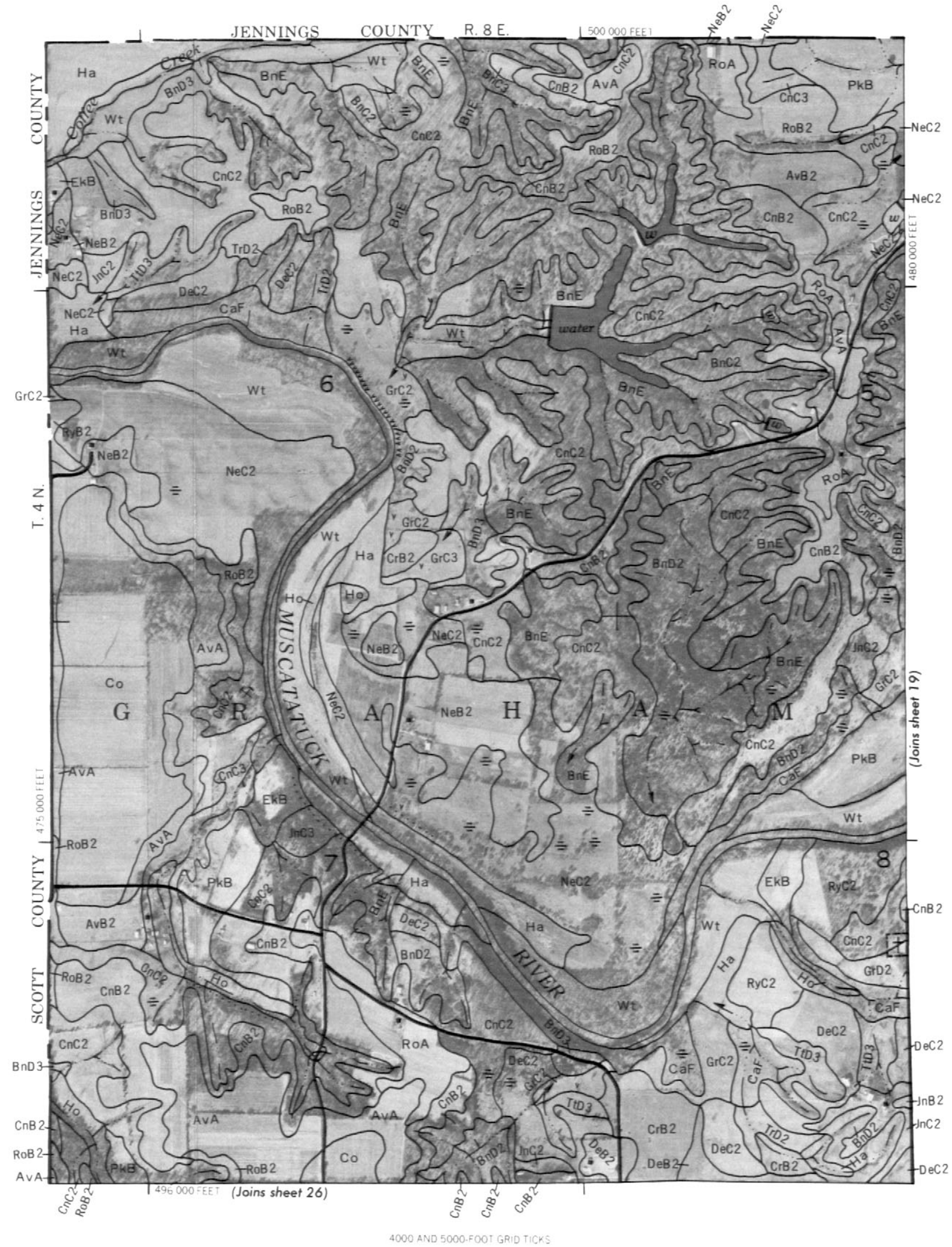

N
(Joins sheet 10)
(Joins sheet 15)
(Joins sheet 17)
(Joins sheet 24)
R. 11 E.
T. 5 N.
610 000 FEET
600 000 FEET
490 000 FEET
485 000 FEET
BACON RIDGE
HALLS RIDGE
Dry Fork
S H E L B Y
26
27
28
29
32
33
34
35
1 Mile
5 000 Feet
Scale 1:15 840
RoA
AvA
RoB2
CnB2
CnC2
CcC2
BeD3
EfF
EeD2
NnB2
SwB2
BnC2
BnD2
BnE
CdC3
SxC2
CrB2
Db


N
(Joins sheet 11)
(Joins sheet 16)
(Joins sheet 25)
R. 11 E. | R. 12 E.
T. 5 N.
615 000 FEET
630 000 FEET
490 000 FEET
485 000 FEET
CREEK
KENTUCK
Seals
Fork
INDIAN
SCOTTS
RIDGE
Brushy
Fork
SHELBY
SWITZERLAND COUNTY
25
26
29
30
31
32
35
36
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
EfF
EeD2
CcC2
NnB2
BnD2
BnD3
BnE
CnB2
CnC2
CnC3
CdC3
SwB2
SxC2
Db
Da
Hu
Wt
EkB
RoB2

JEFFERSON COUNTY, INDIANA — SHEET NUMBER 18

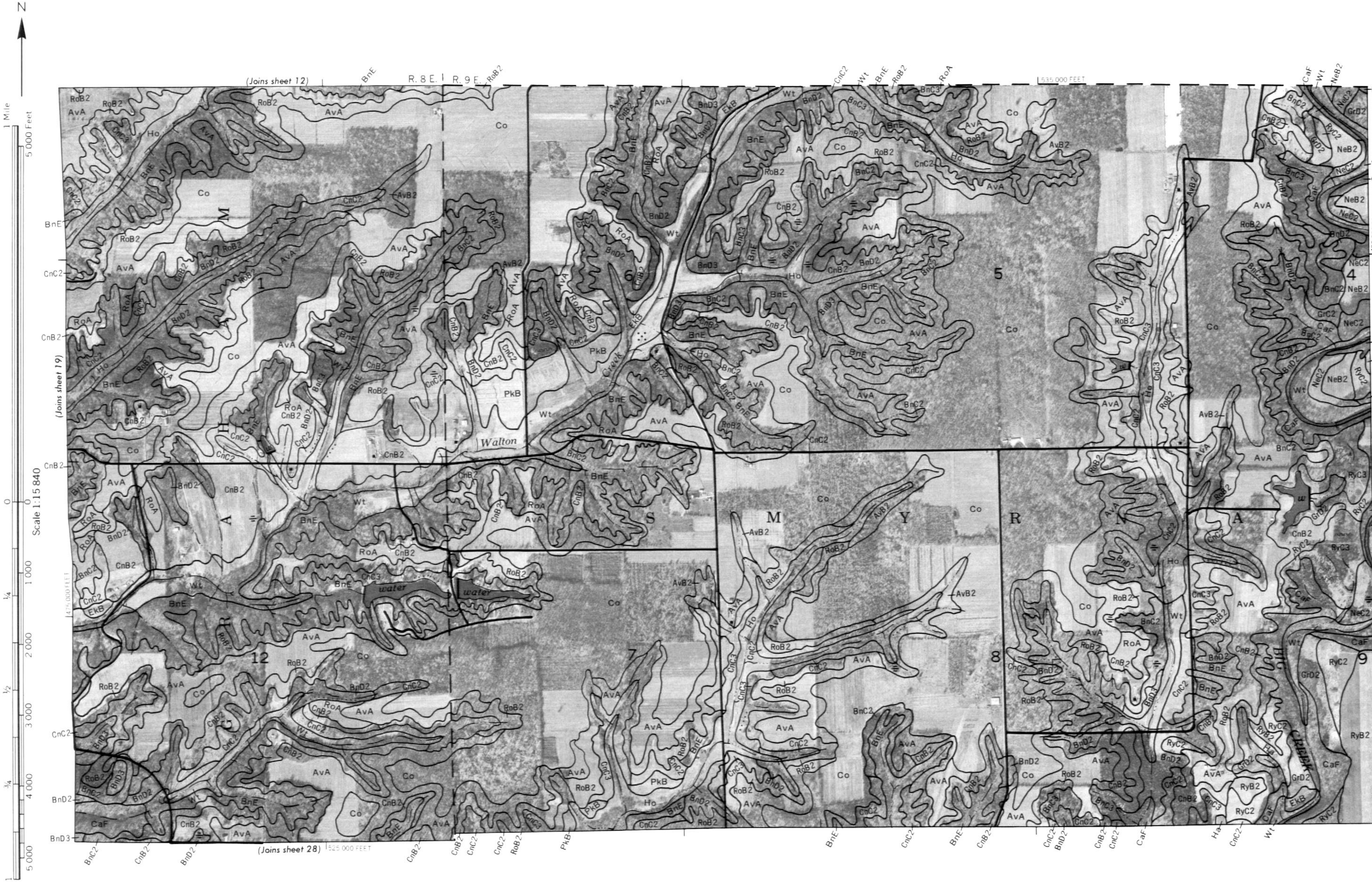
INSET






N
R. 8 E.
JENNINGS COUNTY
(Joins inset, sheet 18)
(Joins sheet 20)
(Joins sheet 27)
(Joins sheet 18)
T. 4 N.
505 000 FEET
480 000 FEET
475 000 FEET
520 000 FEET
BIG CREEK
GRAHAM CREEK
MUSCATATUCK RIVER
Lewis Creek
Veils Creek
1 Mile
5 000 Feet
Scale 1:15 840

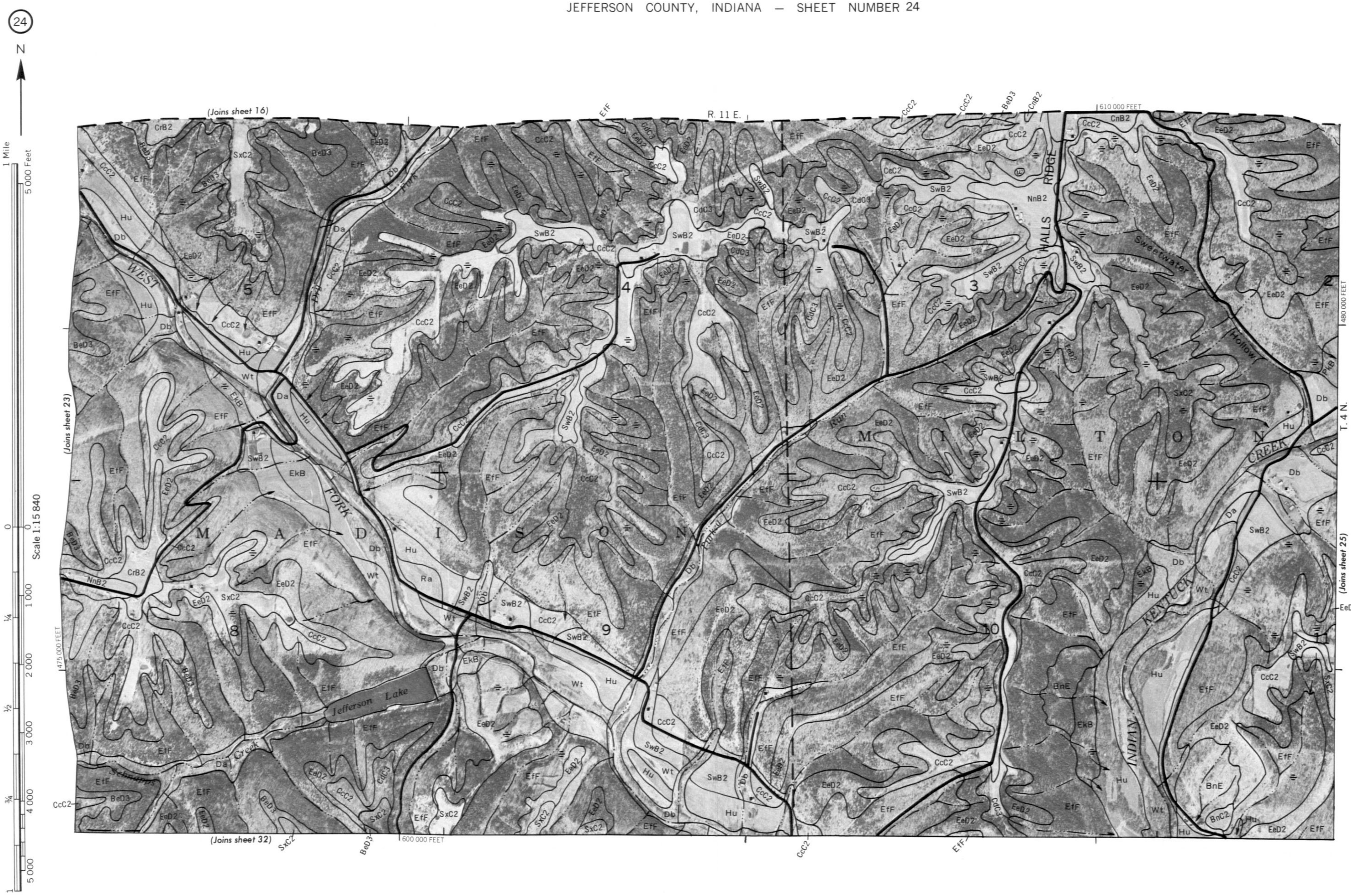
JEFFERSON COUNTY, INDIANA — SHEET NUMBER 20

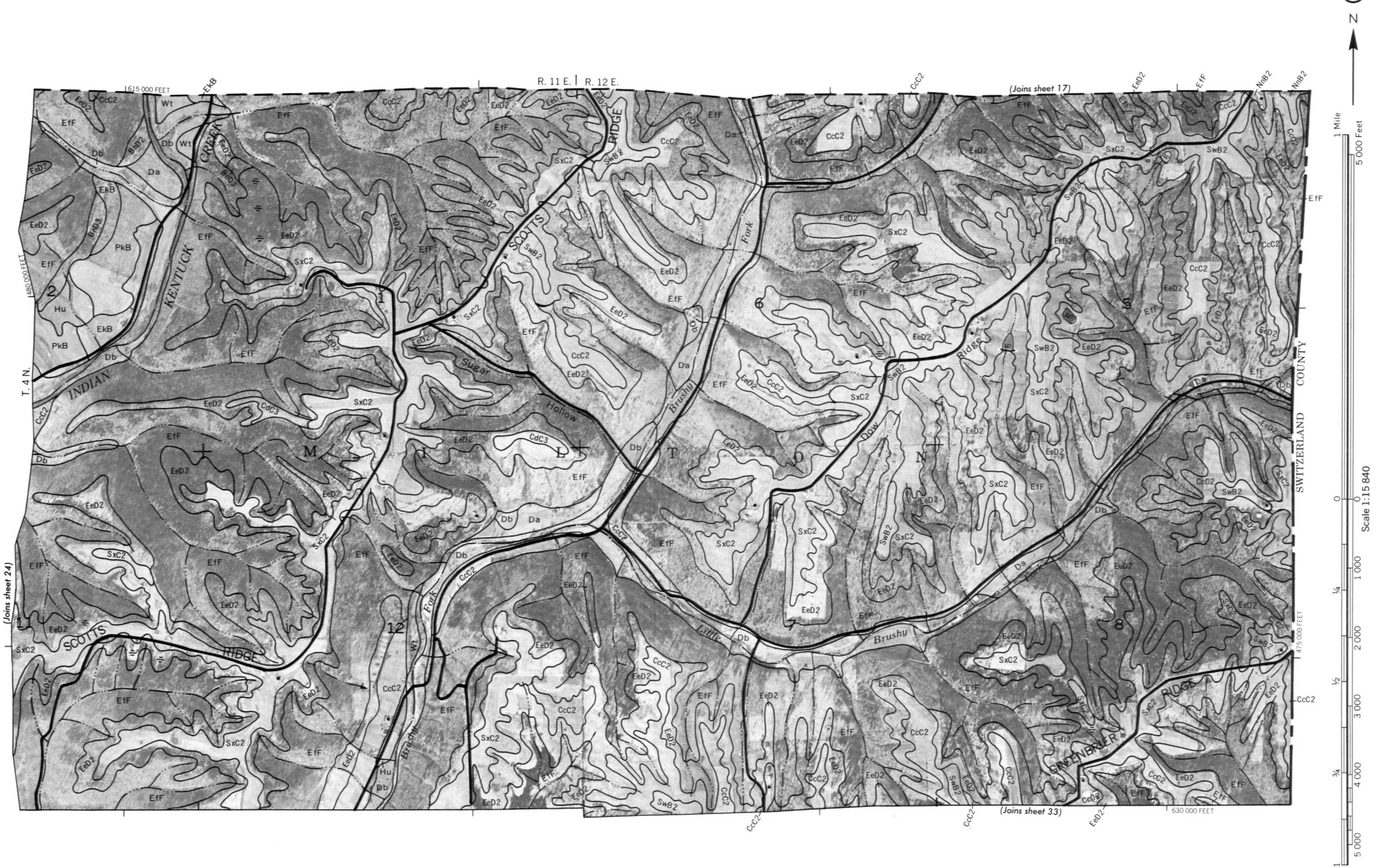


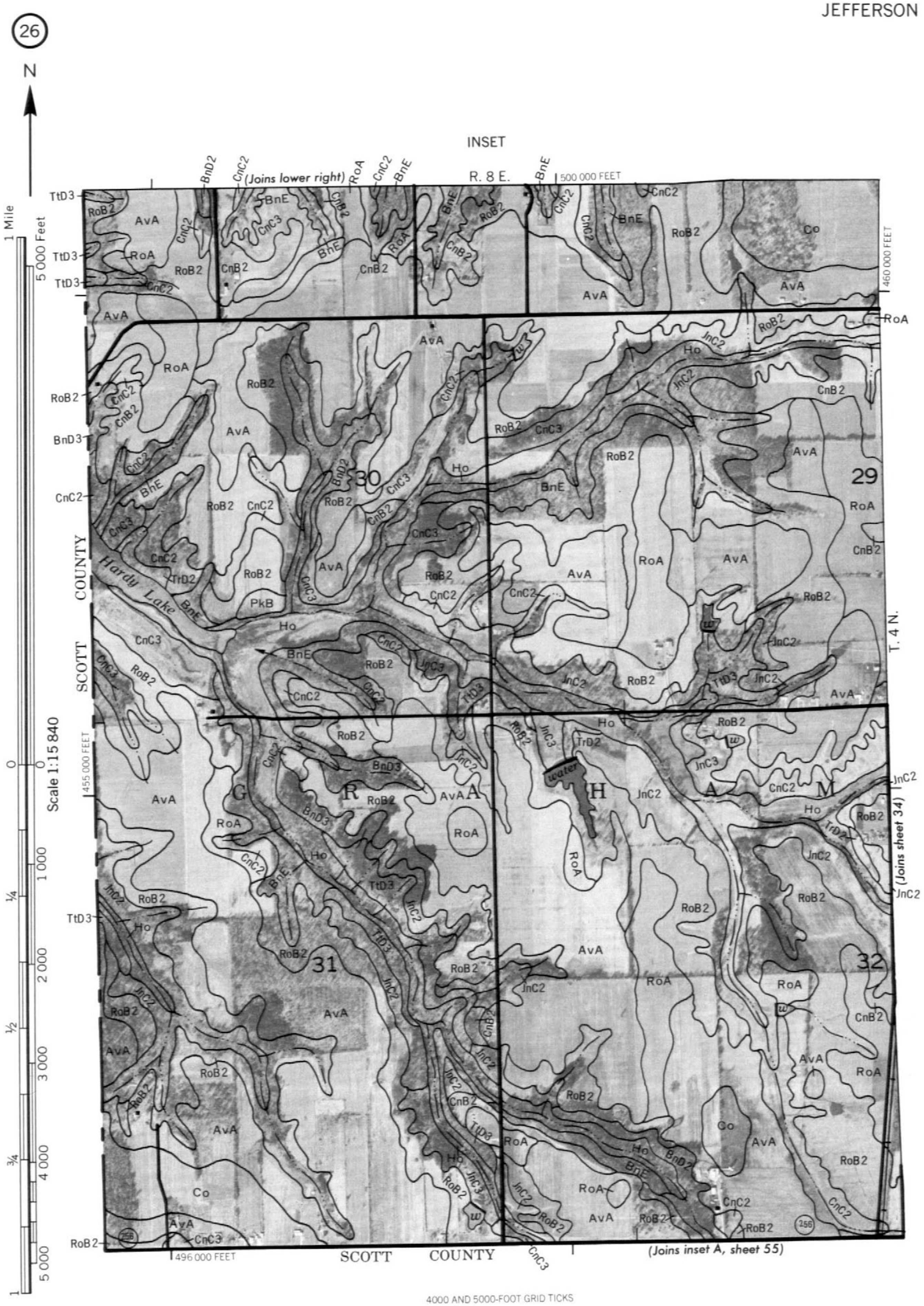

N
(Joins sheet 13)
(Joins sheet 22)
(Joins sheet 29)
(Joins sheet 20)
R. 9 E.
T. 4 N.
540 000 FEET
480 000 FEET
475 000 FEET
555 000 FEET
Midway
Hensley
Creek
Big Creek
S M Y R A
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1
2
3
4
9
10
11
12
Water

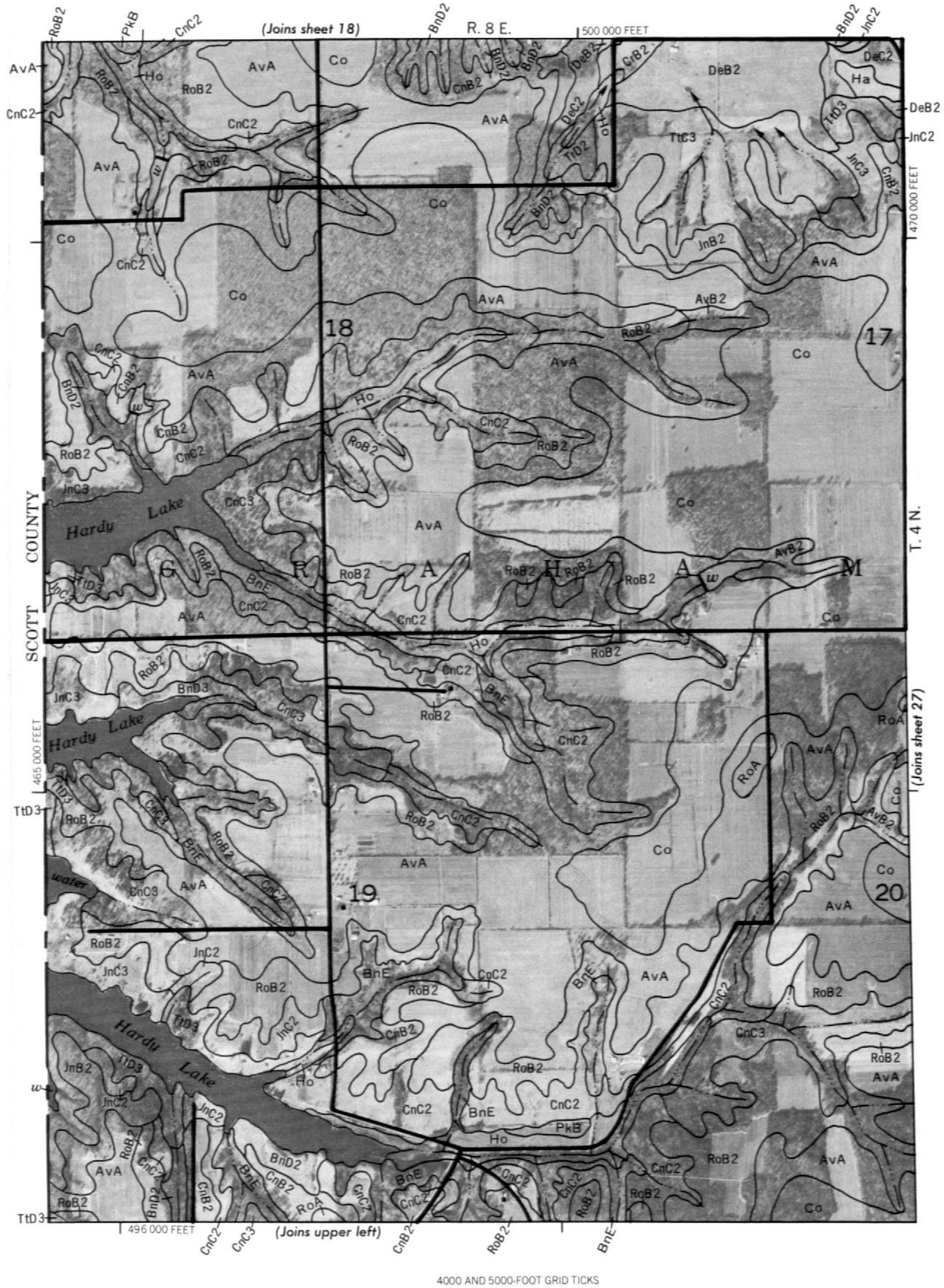
JEFFERSON COUNTY, INDIANA — SHEET NUMBER 22

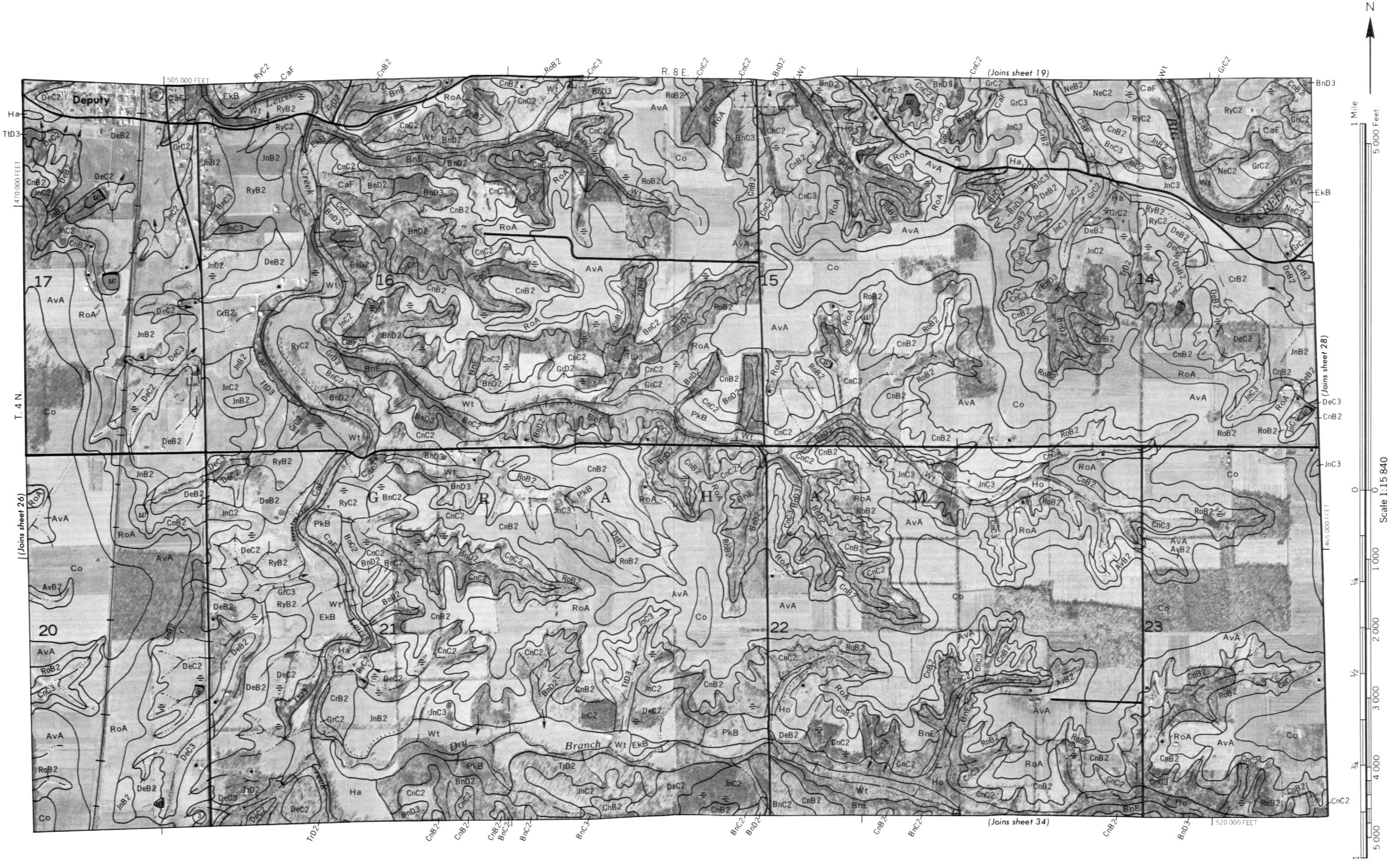

23
N
(Joins sheet 15)
(Joins sheet 24)
(Joins sheet 31)
(Joins sheet 22)
R. 10 E. | R. 11 E.
T. 4 N.
JEFFERSON PROVING GROUND
MADISON
China
Razor Fork
West Fork
Schnapps Creek
580 000 FEET
480 000 FEET
475 000 FEET
595 000 FEET
Scale 1:15 840
1 Mile
5 000 Feet

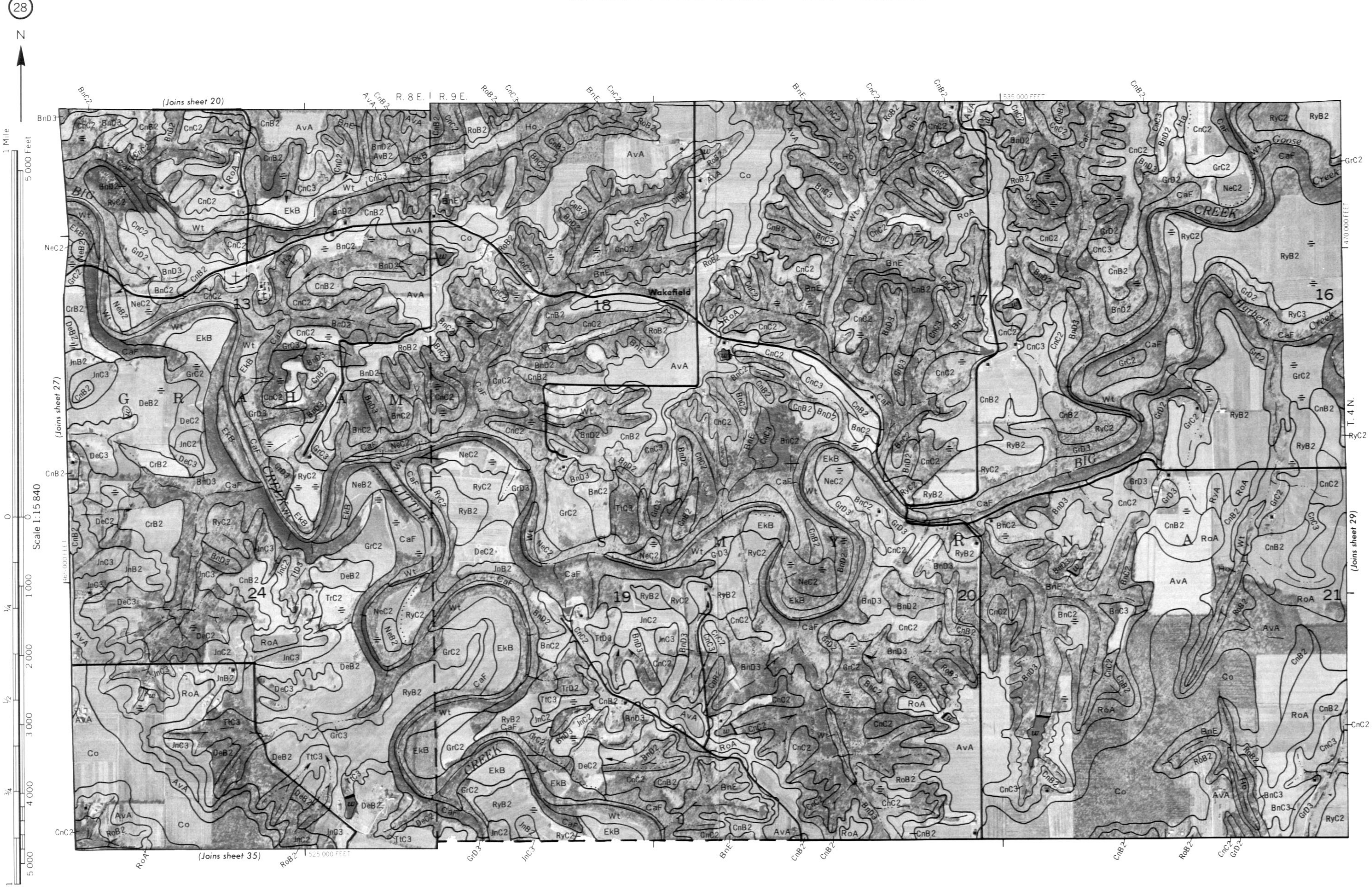

24
N
1 Mile
5 000 Feet
0
Scale 1:15 840
1 000
¼
2 000
½
3 000
¾
4 000
5 000
(Joins sheet 16)
(Joins sheet 23)
(Joins sheet 25)
(Joins sheet 32)
R. 11 E.
T. 4 N.
610 000 FEET
600 000 FEET
480 000 FEET
475 000 FEET
WEST
FORK
MADISON
MILTON
HALLS RIDGE
Sweetwater
Hollow
KENTUCK CREEK
INDIAN
Jefferson Lake
Creek
Run
Fork
Dry
Schunpps
5
4
3
2
8
9
10
11


N
R. 11 E. | R. 12 E.
615 000 FEET
480 000 FEET
475 000 FEET
630 000 FEET
(Joins sheet 17)
(Joins sheet 24)
(Joins sheet 33)
T. 4 N.
SWITZERLAND COUNTY
KENTUCK CREEK
INDIAN
SCOTTS RIDGE
Sugar Hollow
Brushy Fork
Little Brushy
Dow Ridge
GREENBRIER RIDGE
M I L T O N
1 Mile
5 000 Feet
Scale 1:15 840


26
N
1 Mile
5 000 Feet
Scale 1:15 840
INSET
(Joins lower right)
R. 8 E.
500 000 FEET
460 000 FEET
455 000 FEET
T. 4 N.
(Joins sheet 34)
SCOTT COUNTY
Hardy Lake
G R A H A M
30
29
31
32
496 000 FEET
(Joins inset A, sheet 55)
4000 AND 5000-FOOT GRID TICKS


(Joins sheet 18)
R. 8 E.
500 000 FEET
470 000 FEET
465 000 FEET
T. 4 N.
(Joins sheet 27)
SCOTT COUNTY
Hardy Lake
G R A H A M
18
17
19
20
496 000 FEET
(Joins upper left)
4000 AND 5000-FOOT GRID TICKS


N
Deputy
Lewis Creek
BIG CREEK
Dry Branch
GRAHAM
R. 8 E.
T. 4 N.
(Joins sheet 19)
(Joins sheet 26)
(Joins sheet 28)
(Joins sheet 34)
505 000 FEET
470 000 FEET
465 000 FEET
520 000 FEET
17
16
15
14
20
21
22
23
1 Mile
5 000 Feet
Scale 1:15 840


28
N
(Joins sheet 20)
(Joins sheet 27)
(Joins sheet 29)
(Joins sheet 35)
R. 8 E.
R. 9 E.
T. 4 N.
Wakefield
BIG CREEK
LITTLE CREEK
Goose Creek
Harberts Creek
G R A H A M
S M Y R N A
13
16
17
18
19
20
21
24
535 000 FEET
525 000 FEET
470 000 FEET
Scale 1:15 840
1 Mile
5 000 Feet

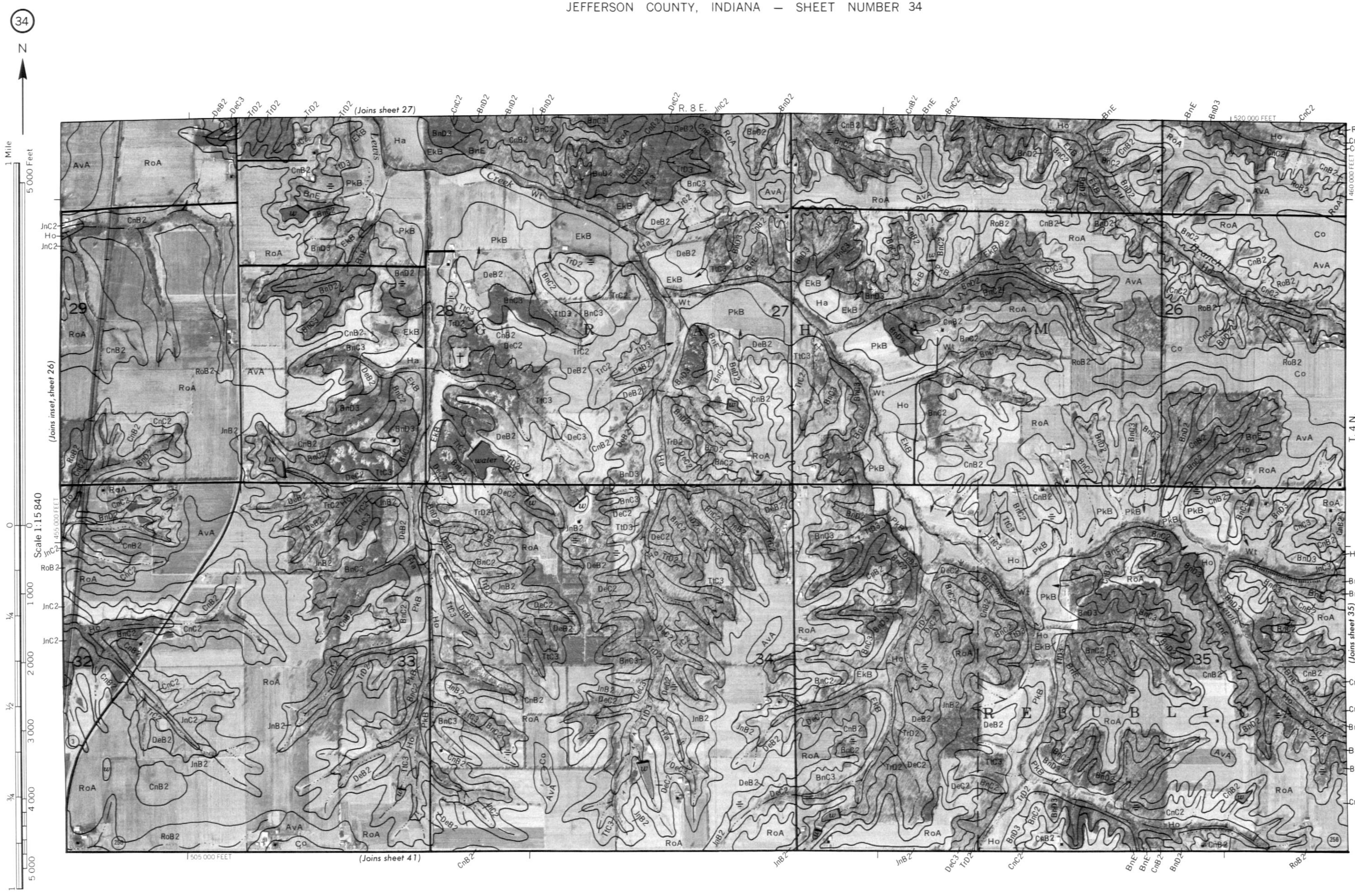

N
(Joins sheet 21)
(Joins sheet 28)
(Joins sheet 30)
(Joins sheet 36)
R. 9 E.
T. 4 N.
540 000 FEET
555 000 FEET
470 000 FEET
465 000 FEET
Volga
Smyrna
Harberts Creek
Goose Creek
Chicken Run
S M Y R N A
water
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
1/4
1/2
3/4


30
N
(Joins sheet 22)
R. 10 E.
575 000 FEET
470 000 FEET
(Joins sheet 29)
(Joins sheet 31)
T. 4 N.
(Joins sheet 37)
560 000 FEET
465 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840
MADISON
M A D I S O N
18
17
16
15
19
20
21
22
Big Clifty Creek
Little Clifty Creek
Chicken Run
Clifty Creek
Deans Branch

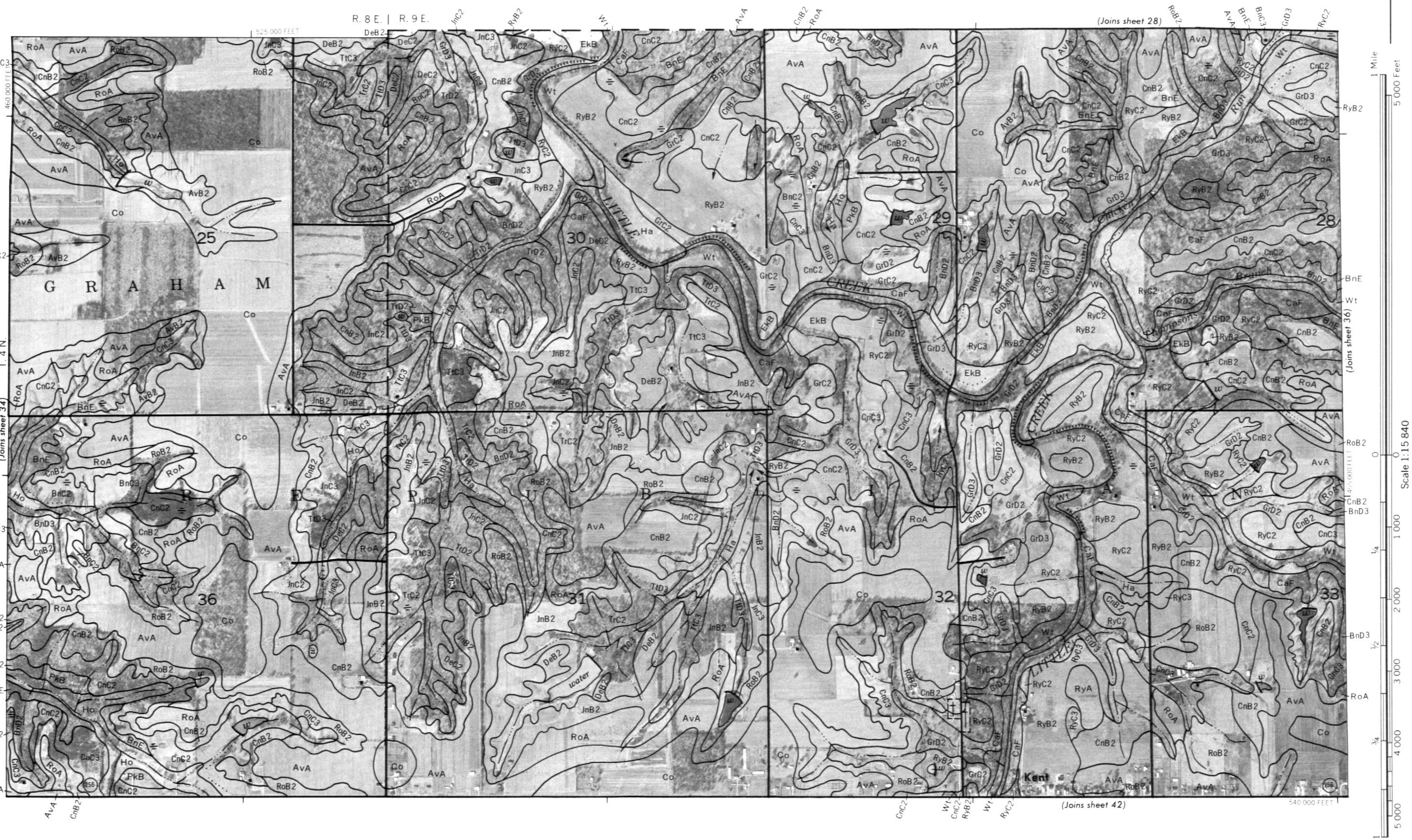

(Joins sheet 23)
(Joins sheet 38)
(Joins sheet 30)
(Joins sheet 32)
R. 10 E.
R. 11 E.
T. 4 N.
580 000 FEET
595 000 FEET
470 000 FEET
465 000 FEET
MADISON
(county seat)
Crooked Creek
Schapps Creek
RYKERS RIDGE
MADISON
N
Scale 1:15 840
1 Mile
5 000 Feet


N
(Joins sheet 24)
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 39)
R. 11 E.
T. 4 N.
610 000 FEET
470 000 FEET
465 000 FEET
600 000 FEET
Scale 1:15 840
1 Mile
5 000 Feet
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000
M A D I S O N
M I L T O N
WEST FORK
INDIAN
KENTUCK
CREEK
Wolf Run
Dog Run
Manville
RYKERS RIDGE
14
15
16
17
20
21
22
23

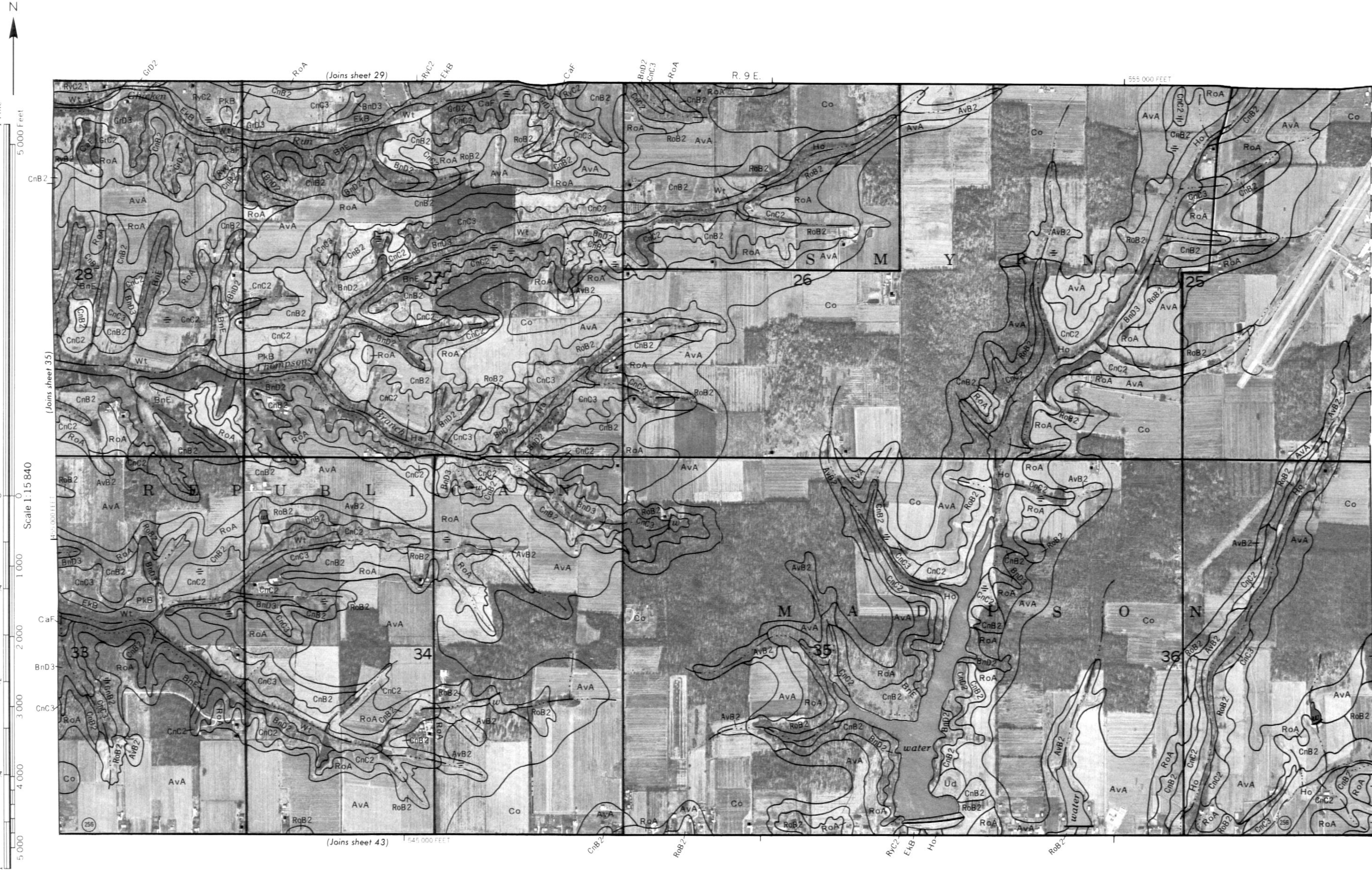

33
N
(Joins sheet 25)
(Joins sheet 32)
(Joins sheet 40)
R. 11 E. | R. 12 E.
T. 4 N.
615 000 FEET
630 000 FEET
470 000 FEET
465 000 FEET
SWITZERLAND COUNTY
M I L T O N
Brushy Fork
Mollys Run
GREENBRIER
RIDGE
Dry Fork
INDIAN KENTUCK CREEK
Vernon Ridge
13
14
17
18
19
20
23
24
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1


34
N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 27)
(Joins sheet 41)
(Joins inset, sheet 26)
(Joins sheet 35)
R. 8 E.
T. 4 N.
455 000 FEET
460 000 FEET
505 000 FEET
520 000 FEET
29
28
27
26
32
33
34
35
GRAHAM
REPUBLICAN
Lewis Creek
Dry Branch
water

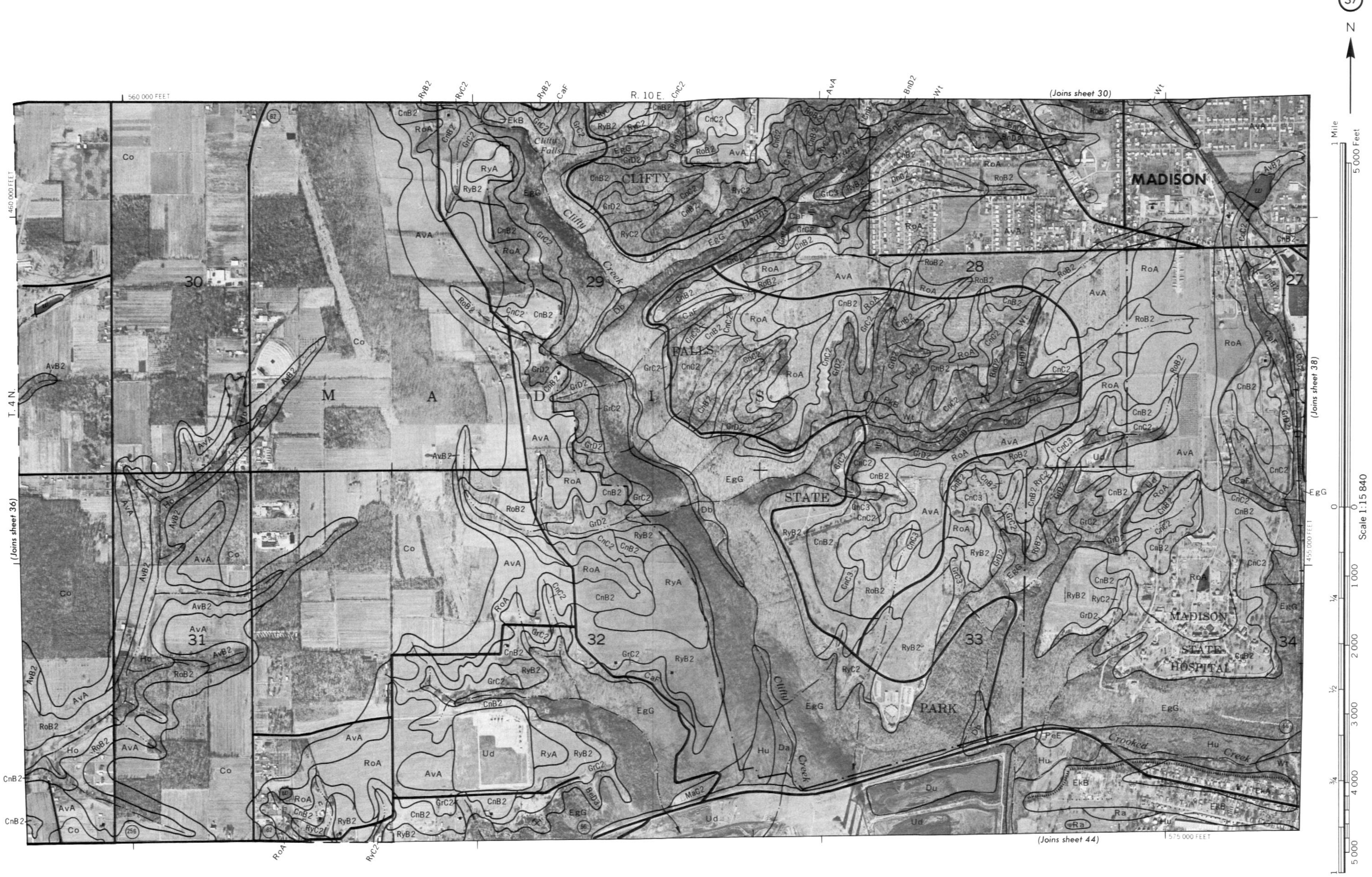
JEFFERSON COUNTY, INDIANA — SHEET NUMBER 35

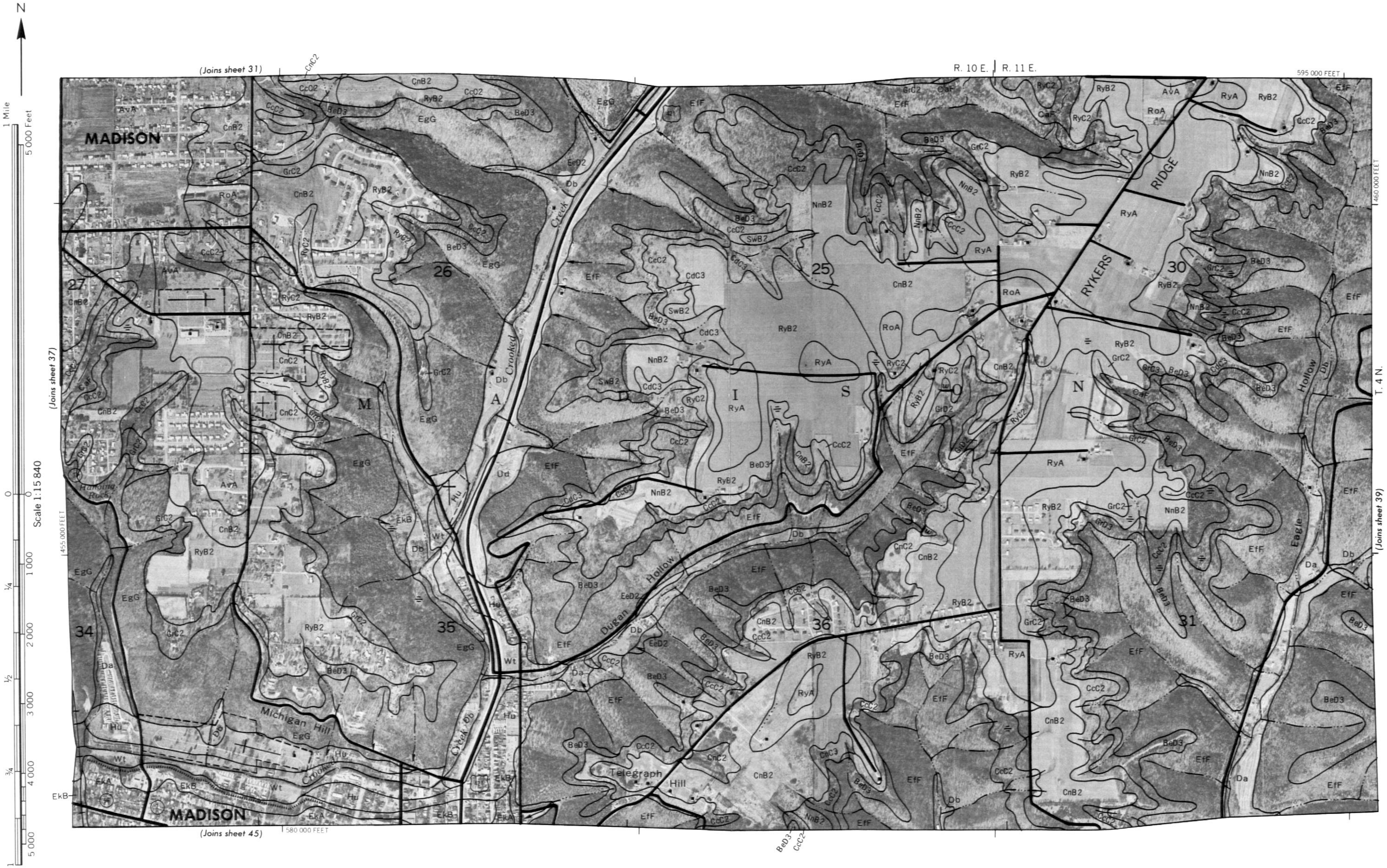


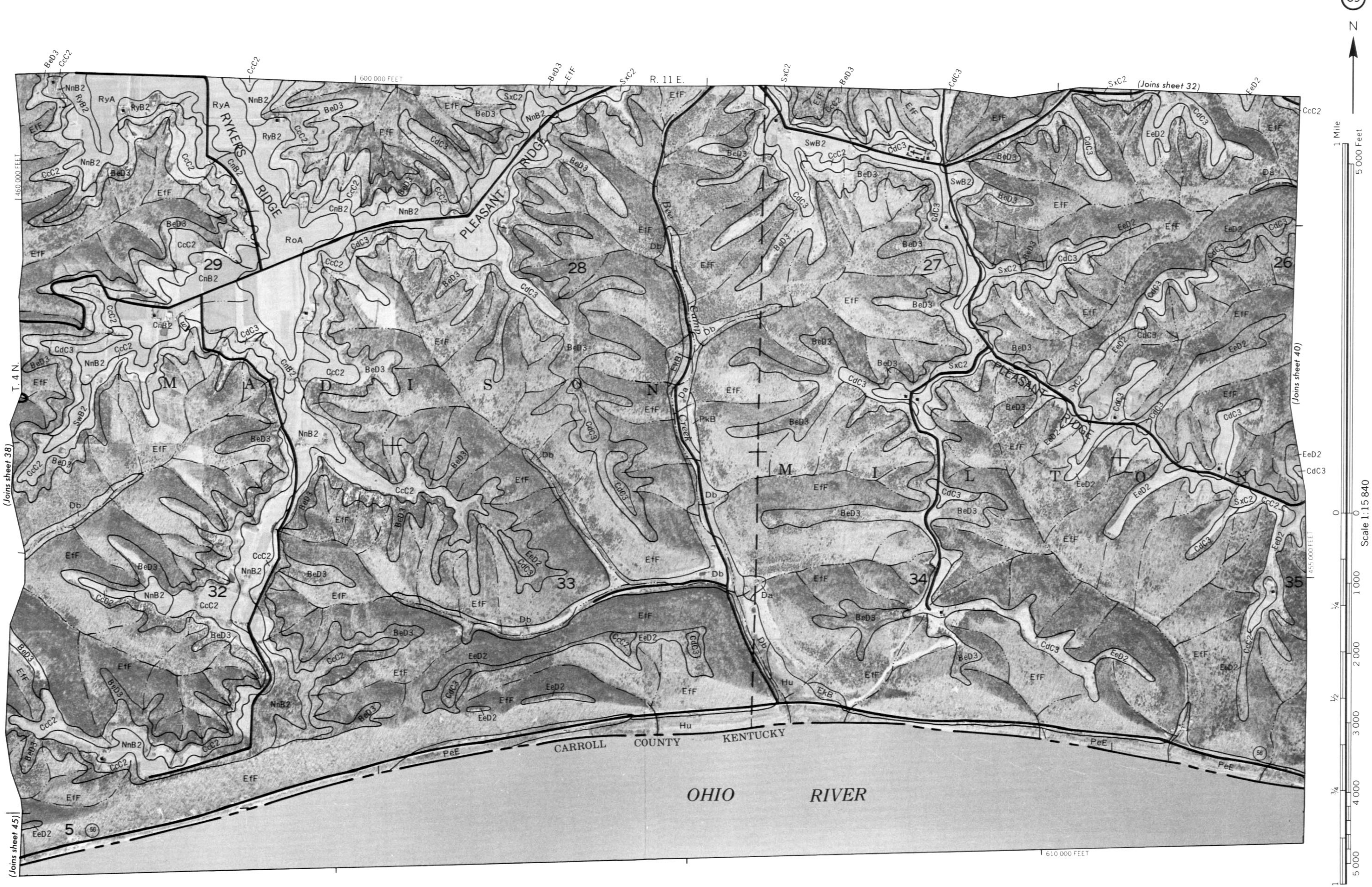
JEFFERSON COUNTY, INDIANA — SHEET NUMBER 36



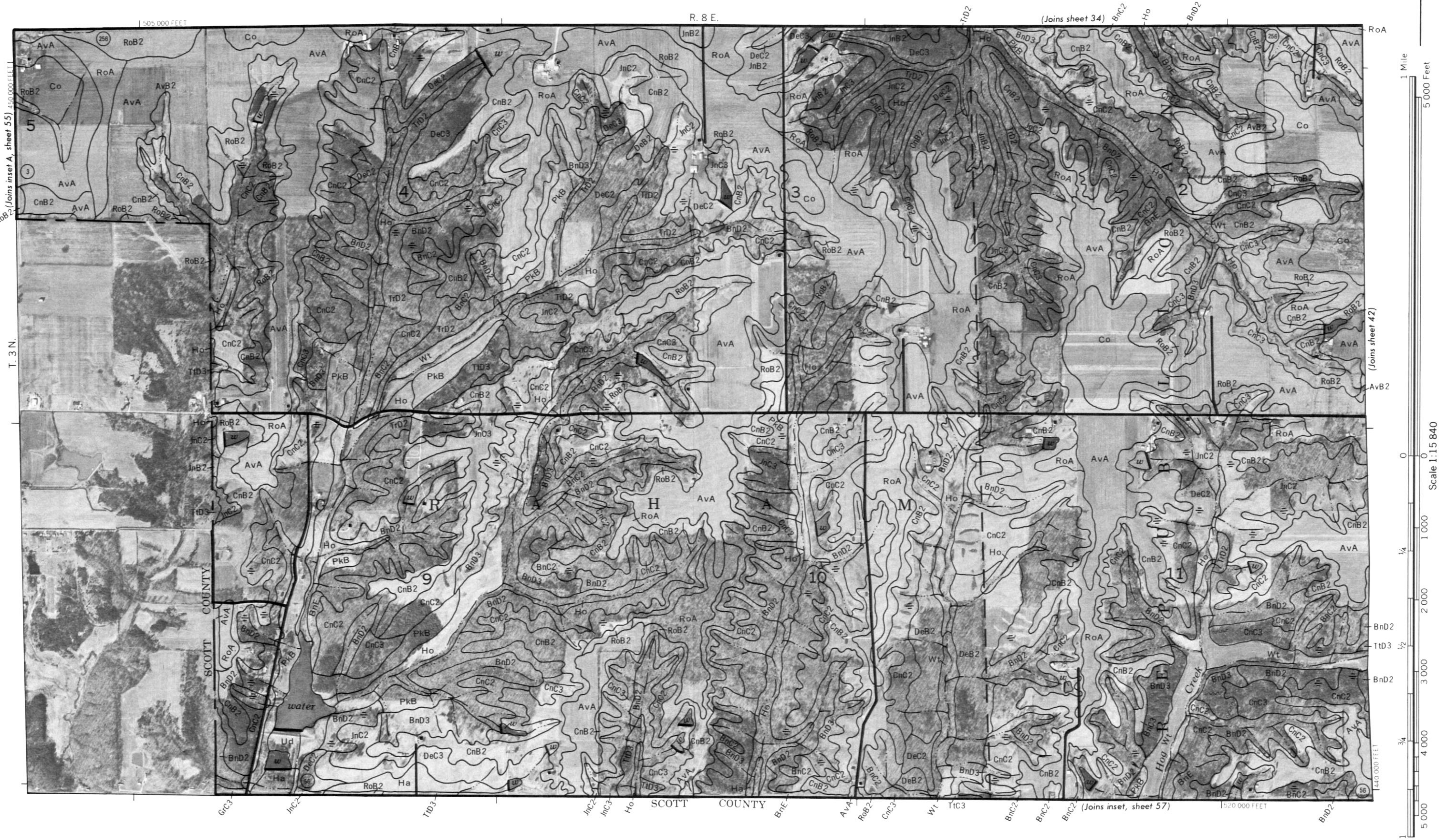
JEFFERSON COUNTY, INDIANA — SHEET NUMBER 37

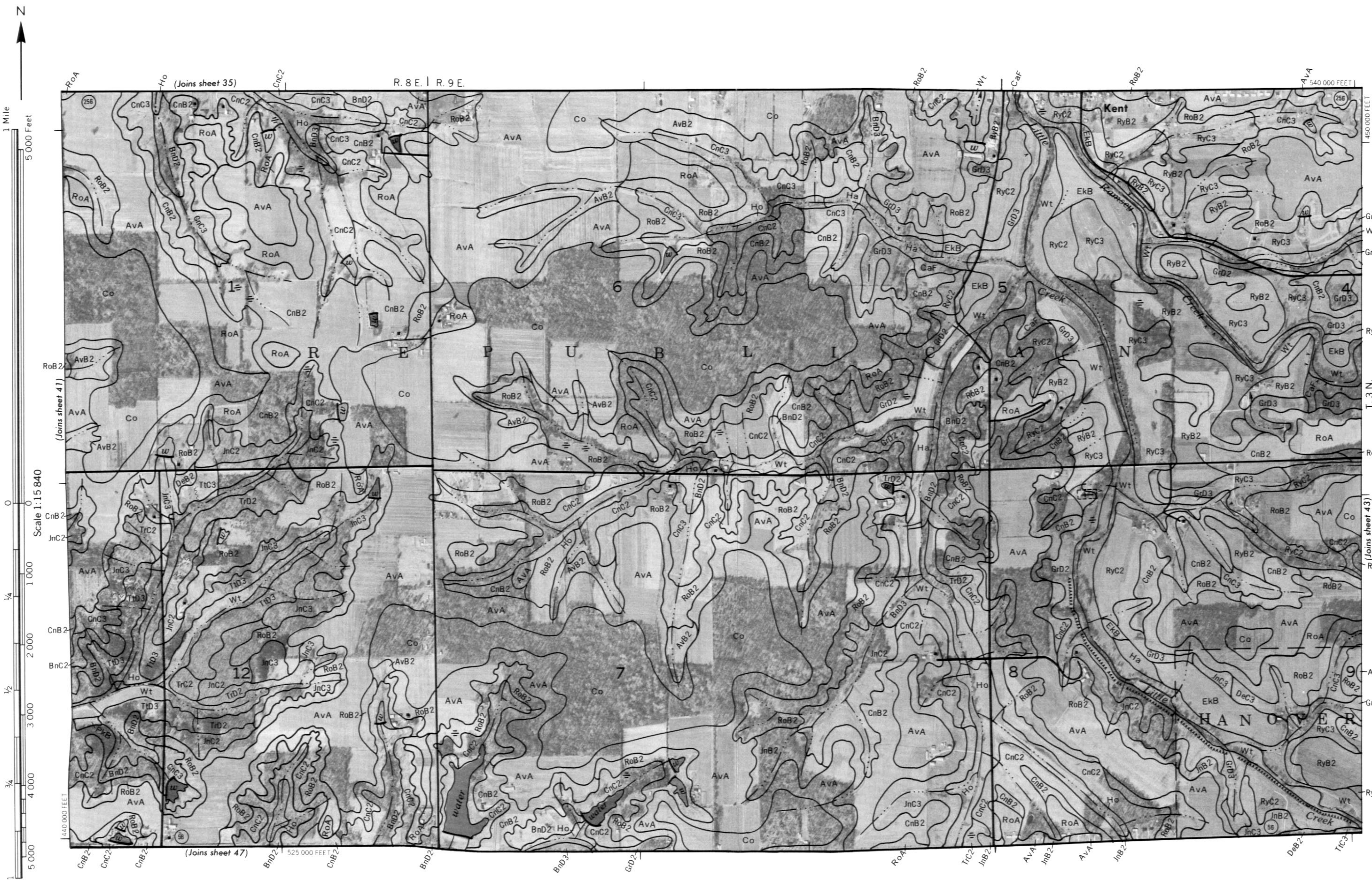



N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 31)
(Joins sheet 37)
(Joins sheet 39)
(Joins sheet 45)
R. 10 E. | R. 11 E.
T. 4 N.
595 000 FEET
460 000 FEET
455 000 FEET
580 000 FEET
MADISON
Hanging Rock
Crooked Creek
Michigan Hill
Dugan Hollow
Telegraph Hill
RYKERS RIDGE
Eagle Hollow
M A D I S O N
26
25
27
30
34
35
36
31

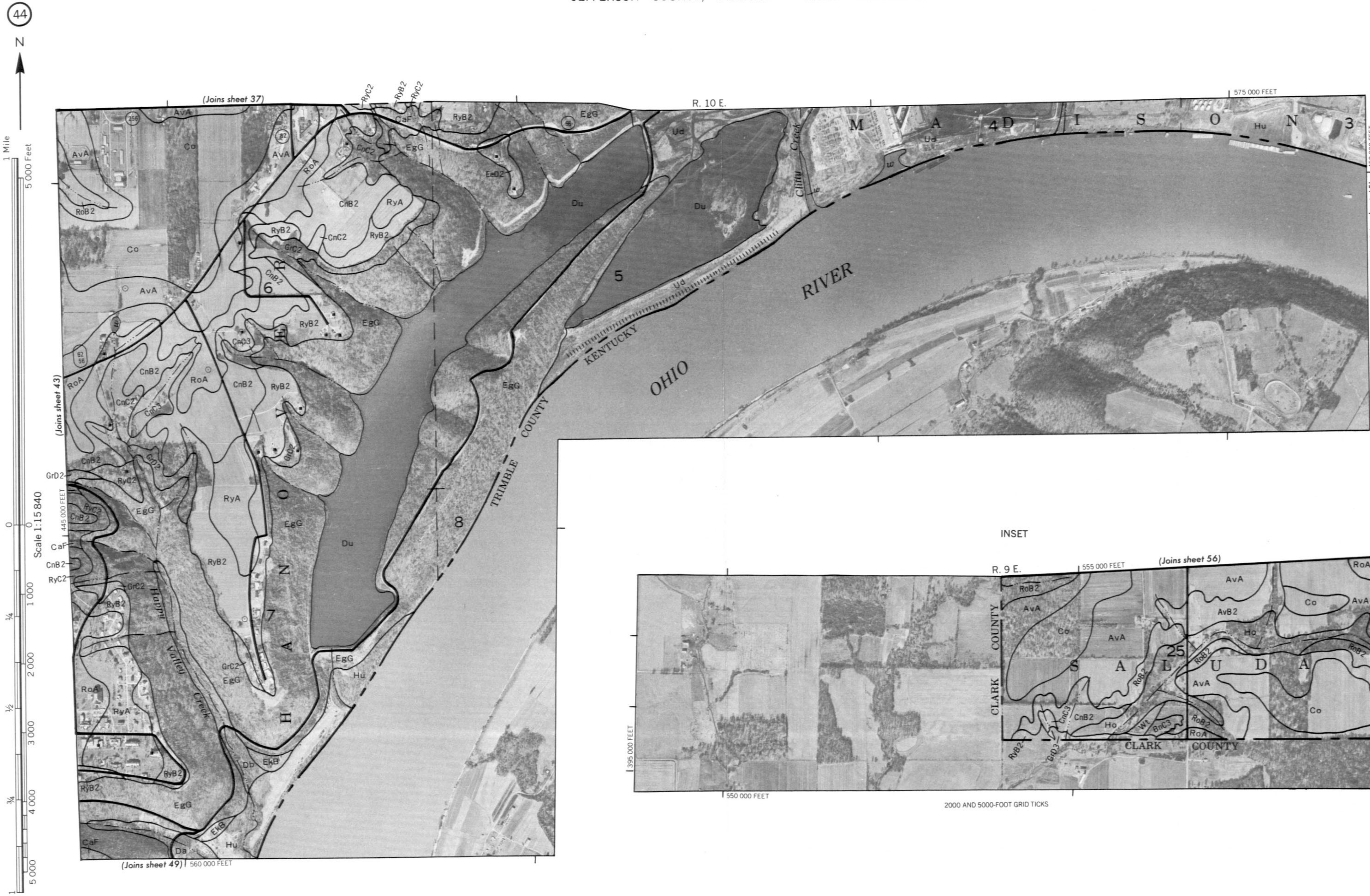

39
N
(Joins sheet 32)
(Joins sheet 38)
(Joins sheet 40)
(Joins sheet 45)
R. 11 E.
T. 4 N.
600 000 FEET
610 000 FEET
460 000 FEET
455 000 FEET
RYKERS RIDGE
PLEASANT RIDGE
M A D I S O N
M I L T O N
Bee Camp Creek
OHIO RIVER
CARROLL COUNTY KENTUCKY
29
28
27
26
32
33
34
35
5
1 Mile
5 000 Feet
Scale 1:15 840


40
N
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
R. 11 E. | R. 12 E.
(Joins sheet 33)
(Joins sheet 39)
(Joins sheet 46)
630 000 FEET
460 000 FEET
455 000 FEET
615 000 FEET
T. 4 N.
SWITZERLAND COUNTY
INDIAN KENTUCK CREEK
Dry Fork
Doe Run
Little Doe Run
Shirks Hollow
25
26
29
30
31
32
35
36
56
water

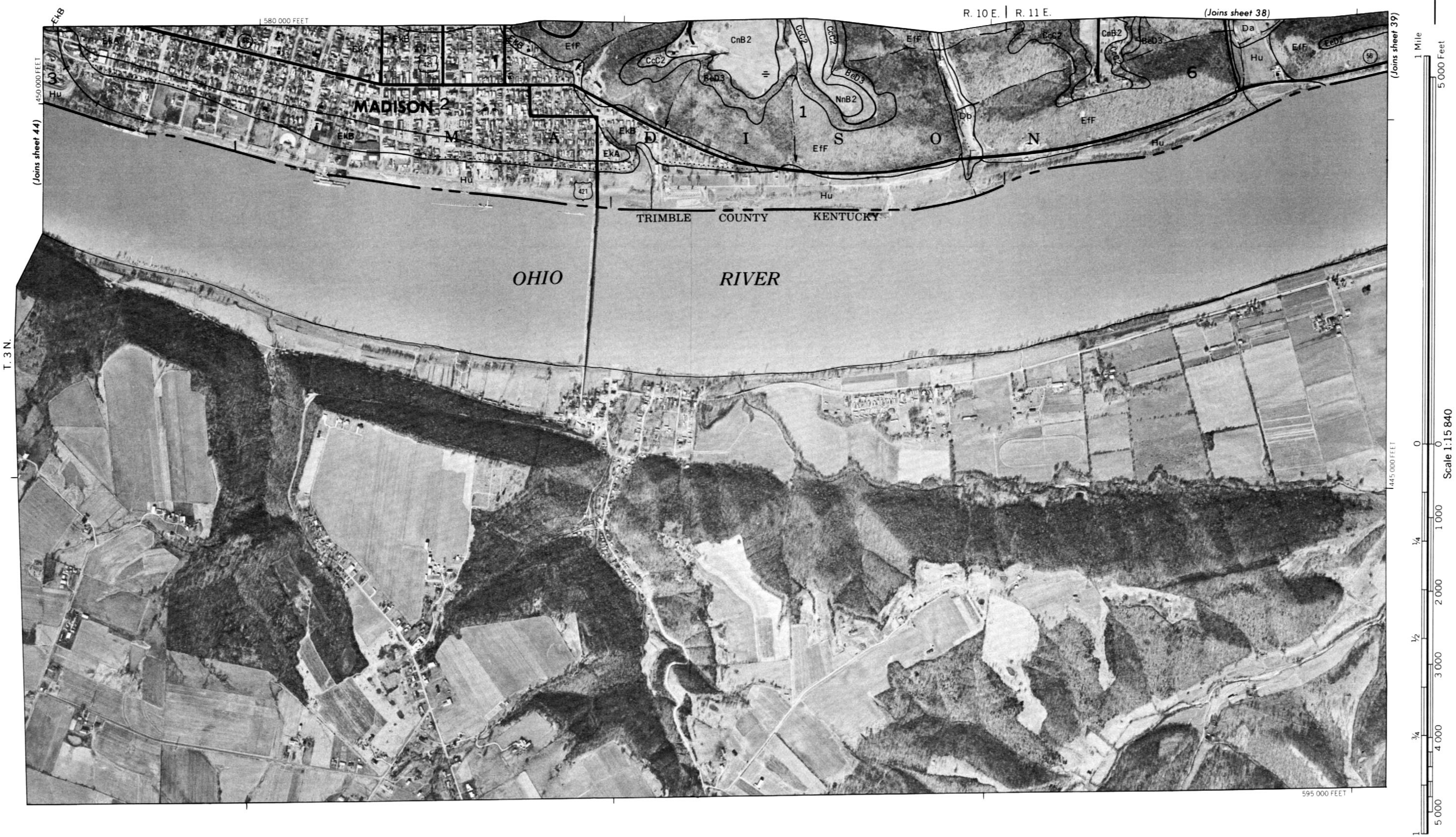

N
R. 8 E.
T. 3 N.
(Joins sheet 34)
(Joins sheet 42)
(Joins inset, sheet 57)
(Joins inset A, sheet 55)
SCOTT COUNTY
SCOTT COUNTY
GRAHAM
REPUBLICAN
Hog Creek
water
505 000 FEET
450 000 FEET
440 000 FEET
520 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840


N
(Joins sheet 35)
(Joins sheet 41)
(Joins sheet 43)
(Joins sheet 47)
R. 8 E.
R. 9 E.
T. 3 N.
540 000 FEET
450 000 FEET
440 000 FEET
525 000 FEET
Scale 1:15 840
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1
REPUBLICAN
HANOVER
Kent
Little Creek
Ramsey Creek
water
256
56
1
4
5
6
7
8
9
12


43
N
R. 9 E.
T. 3 N.
(Joins sheet 36)
(Joins sheet 44)
(Joins sheet 42)
(Joins sheet 48)
545 000 FEET
555 000 FEET
450 000 FEET
445 000 FEET
HANOVER
Ramsey Creek
water
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1
0
1000
2000
3000
4000
5000



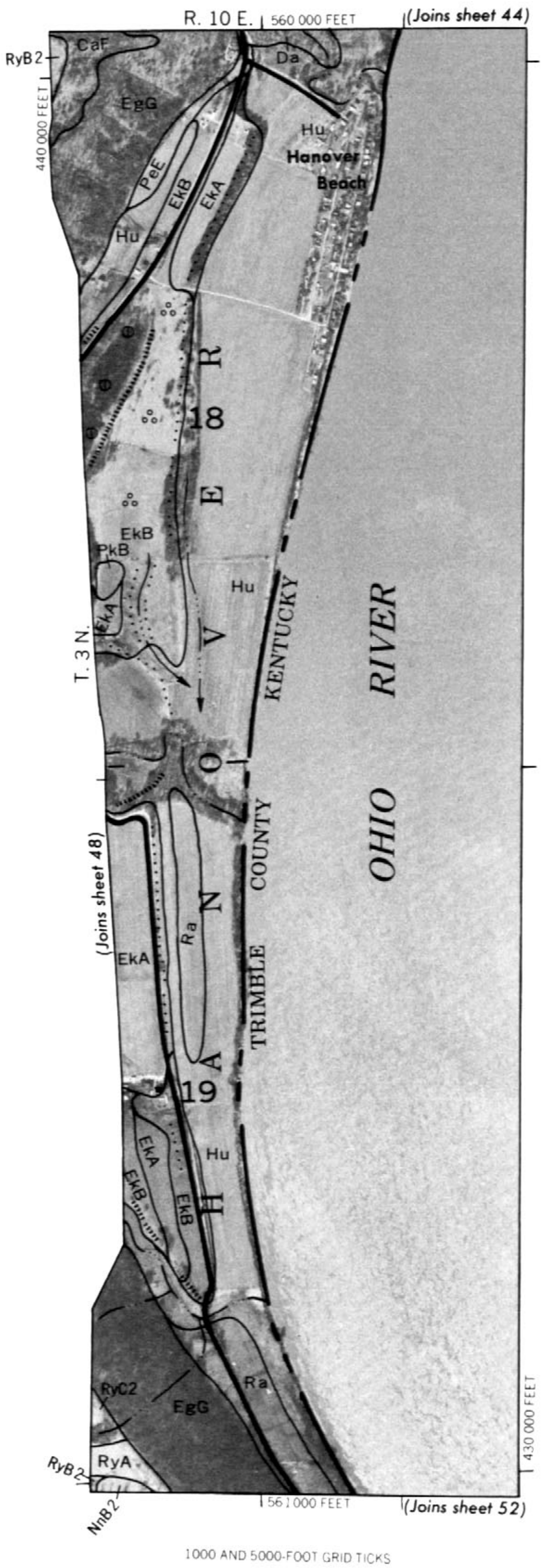
2000 AND 5000-FOOT GRID TICKS


N
(Joins sheet 38)
(Joins sheet 39)
(Joins sheet 44)
R. 10 E. | R. 11 E.
T. 3 N.
580 000 FEET
450 000 FEET
445 000 FEET
595 000 FEET
MADISON
M A D I S O N
TRIMBLE COUNTY KENTUCKY
OHIO RIVER
421
56
EkB
EkA
Hu
EfF
CnB2
CcC2
BeD3
NnB2
Db
Da
CmB2
BeD2
1
2
3
6
1 Mile
5 000 Feet
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000
Scale 1:15 840

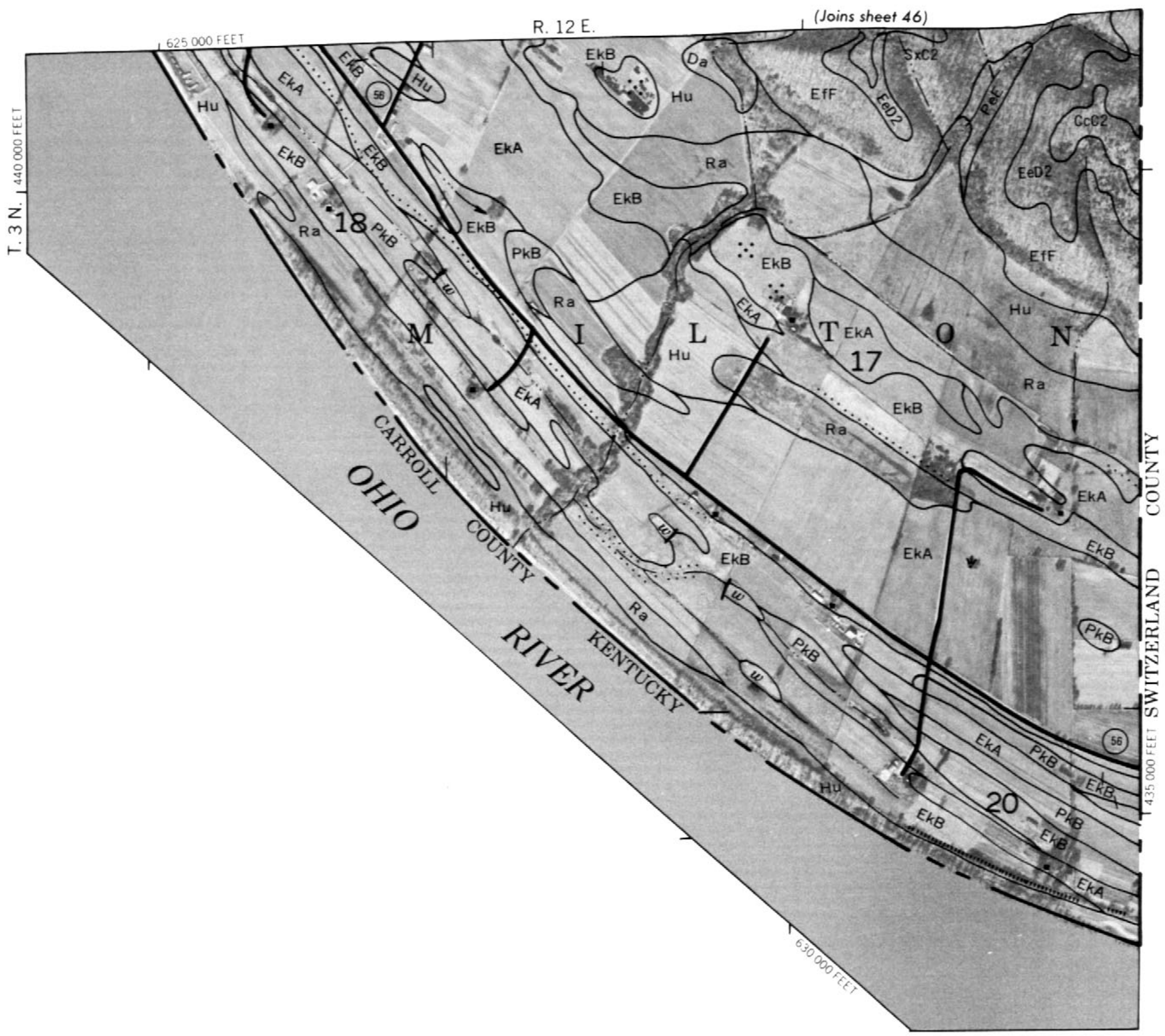

N
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000
(Joins sheet 40)
R. 11 E.
R. 12 E.
630 000 FEET
450 000 FEET
445 000 FEET
615 000 FEET
(Joins inset, sheet 49)
Brooksburg
INDIAN
KENTUCKY
CREEK
OHIO
RIVER
CARROLL
COUNTY
KENTUCKY
M I L T O N
Lost
Fork
Creek
SWITZERLAND
COUNTY
T. 3 N.
56
PeE
EfF
EeD2
Hu
Ra
MaC2
MaB2
EkB
EkA
BnE
BnD2
Da
Db
CcC2
CdC3
SxC2
Wt
PkB


47
N
(Joins sheet 42)
(Joins sheet 48)
(Joins inset, sheet 57)
R. 8 E. | R. 9 E.
T. 3 N.
SCOTT COUNTY
525 000 FEET
435 000 FEET
535 000 FEET
430 000 FEET
REPUBLICAN
HANOVER
Little Caney Fork
Woods Fork
13
16
17
18
19
20
21
24
1 Mile
5 000 Feet
Scale 1:15 840

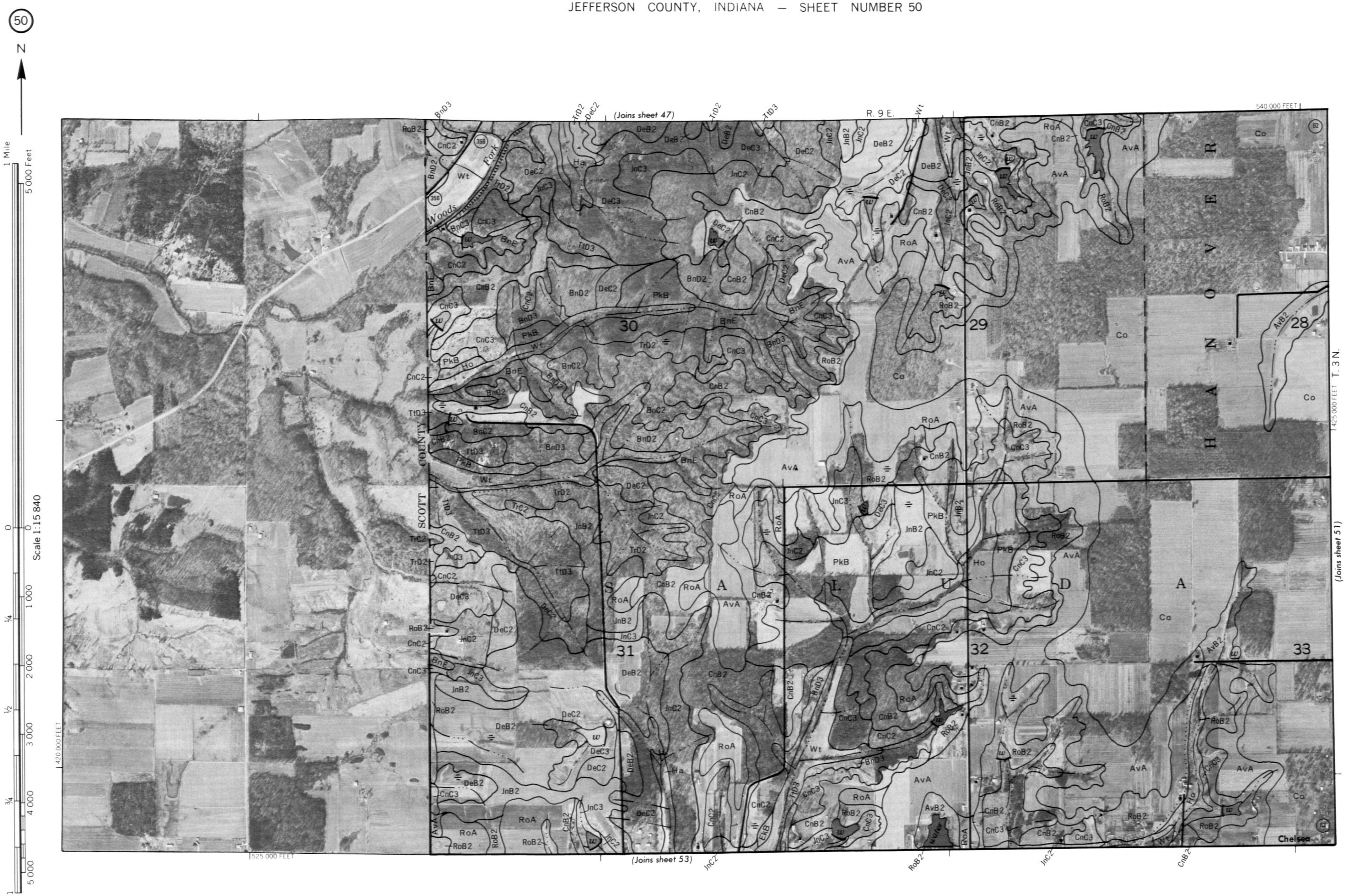

48
N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 43)
R. 9 E.
555 000 FEET
440 000 FEET
(Joins sheet 47)
T. 3 N.
(Joins sheet 49)
(Joins sheet 51)
545 000 FEET
430 000 FEET
Slider Cave
LITTLE CREEK
H A N O V E R
Chain Mill Creek
water
16
15
14
13
21
22
23
24

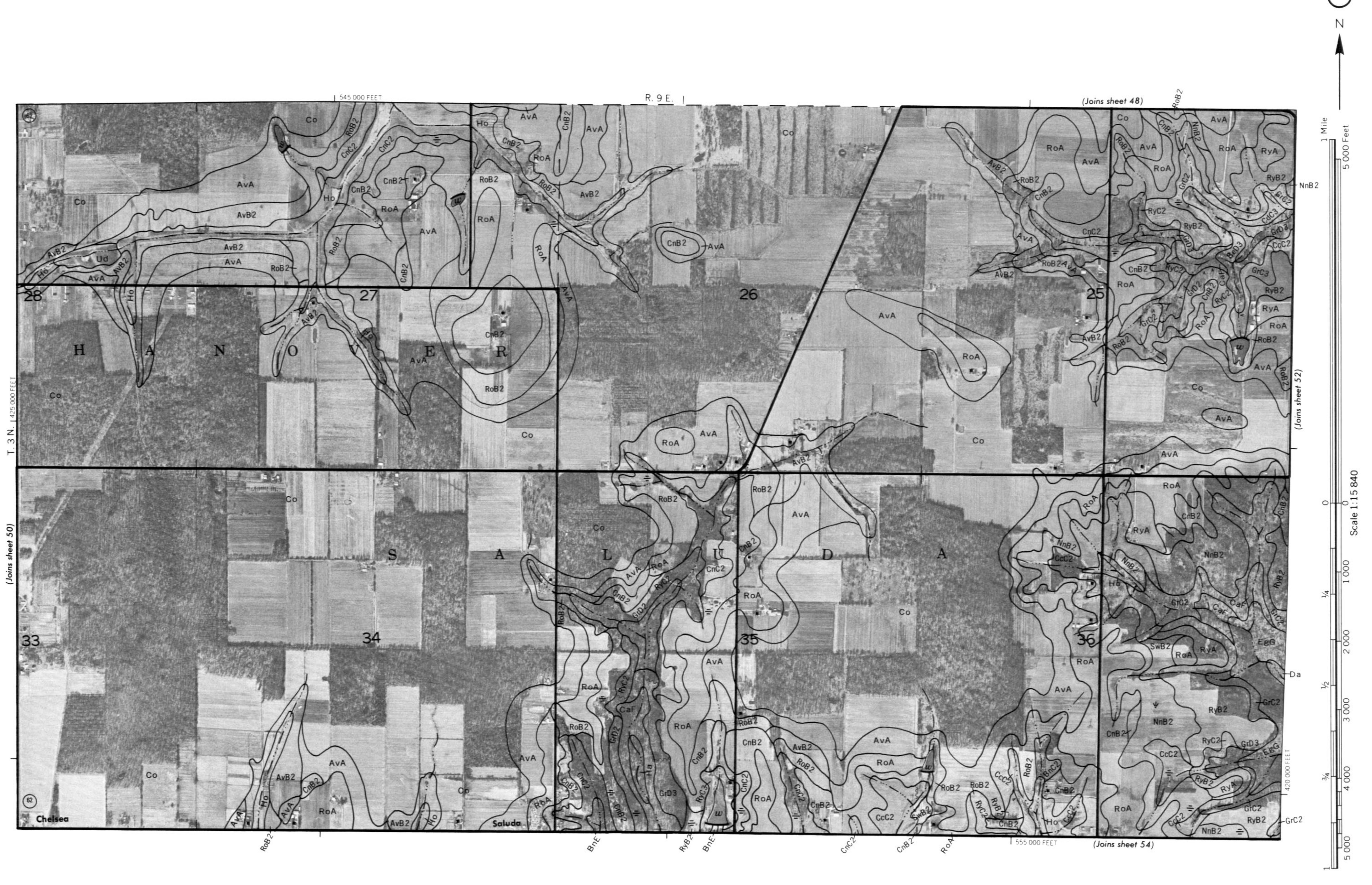

R. 10 E.
560 000 FEET
(Joins sheet 44)
RyB2
CaF
EgG
Da
440 000 FEET
Hu
Hanover
Beach
PeE
EkB
EkA
Hu
R
18
E
EkB
PkB
EkA
Hu
V
T. 3 N.
KENTUCKY
RIVER
O
OHIO
(Joins sheet 48)
N
COUNTY
EkA
Ra
TRIMBLE
A
19
EkA
EkB
EkB
Hu
H
Ra
RyC2
EgG
430 000 FEET
RyB2
RyA
NnB2
561 000 FEET
(Joins sheet 52)
1000 AND 5000-FOOT GRID TICKS

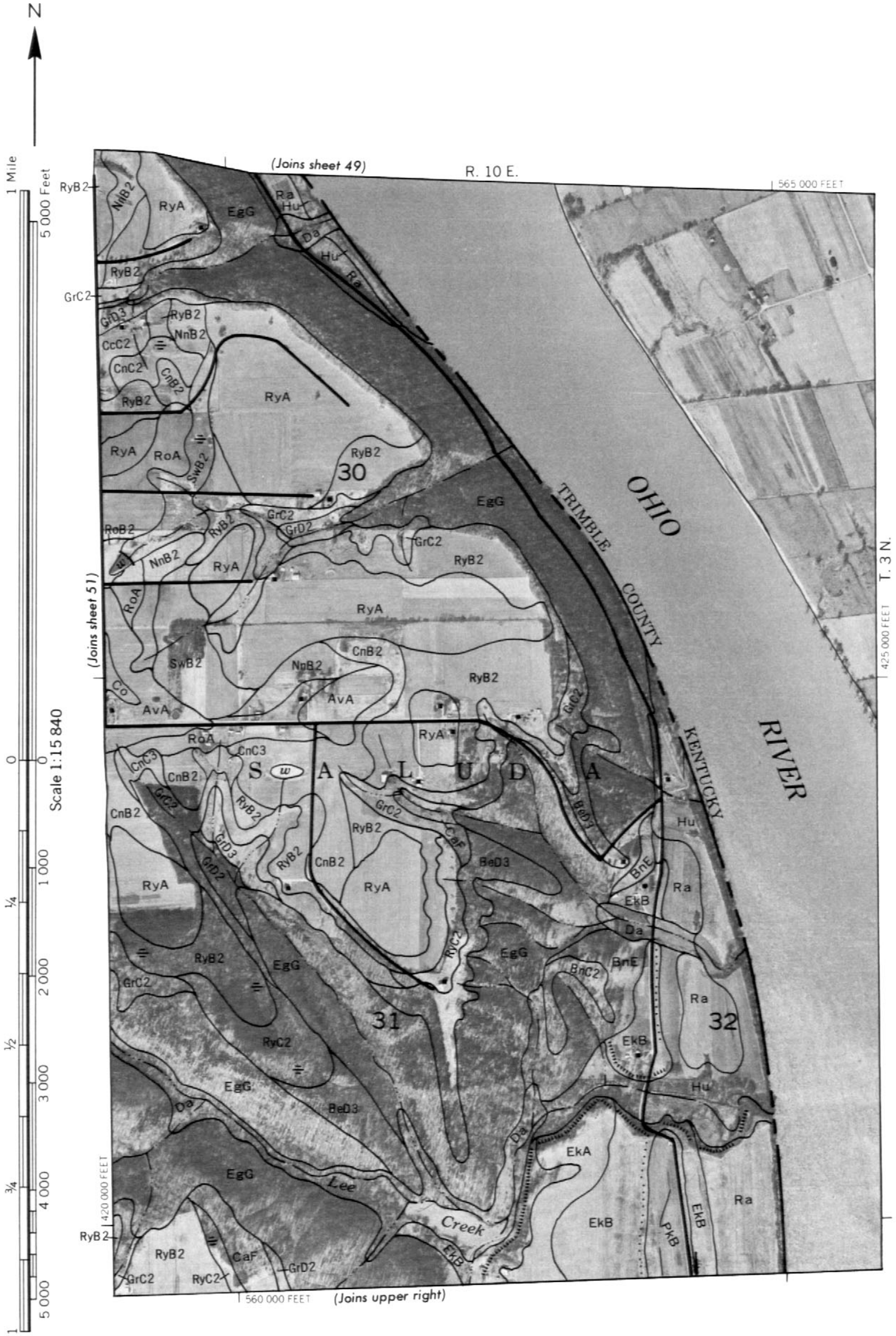
INSET


R. 12 E.
(Joins sheet 46)
625 000 FEET
440 000 FEET
T. 3 N.
EkB
Da
SxC2
Hu
EkA
EkB
56
Hu
Hu
EfF
EeD2
PeE
CcC2
EkA
Ra
EeD2
EkB
EkB
Ra
18
PkB
EkB
PkB
EkB
EfF
Ra
Hu
M
I
L
T
EkA
O
N
Hu
17
EkA
Ra
EkB
Ra
CARROLL
OHIO
Hu
COUNTY
EkA
COUNTY
EkB
EkA
EkB
SWITZERLAND
PkB
RIVER
KENTUCKY
Ra
PkB
56
EkA
PkB
EkB
Hu
20
PkB
EkB
EkB
EkA
435 000 FEET
630 000 FEET

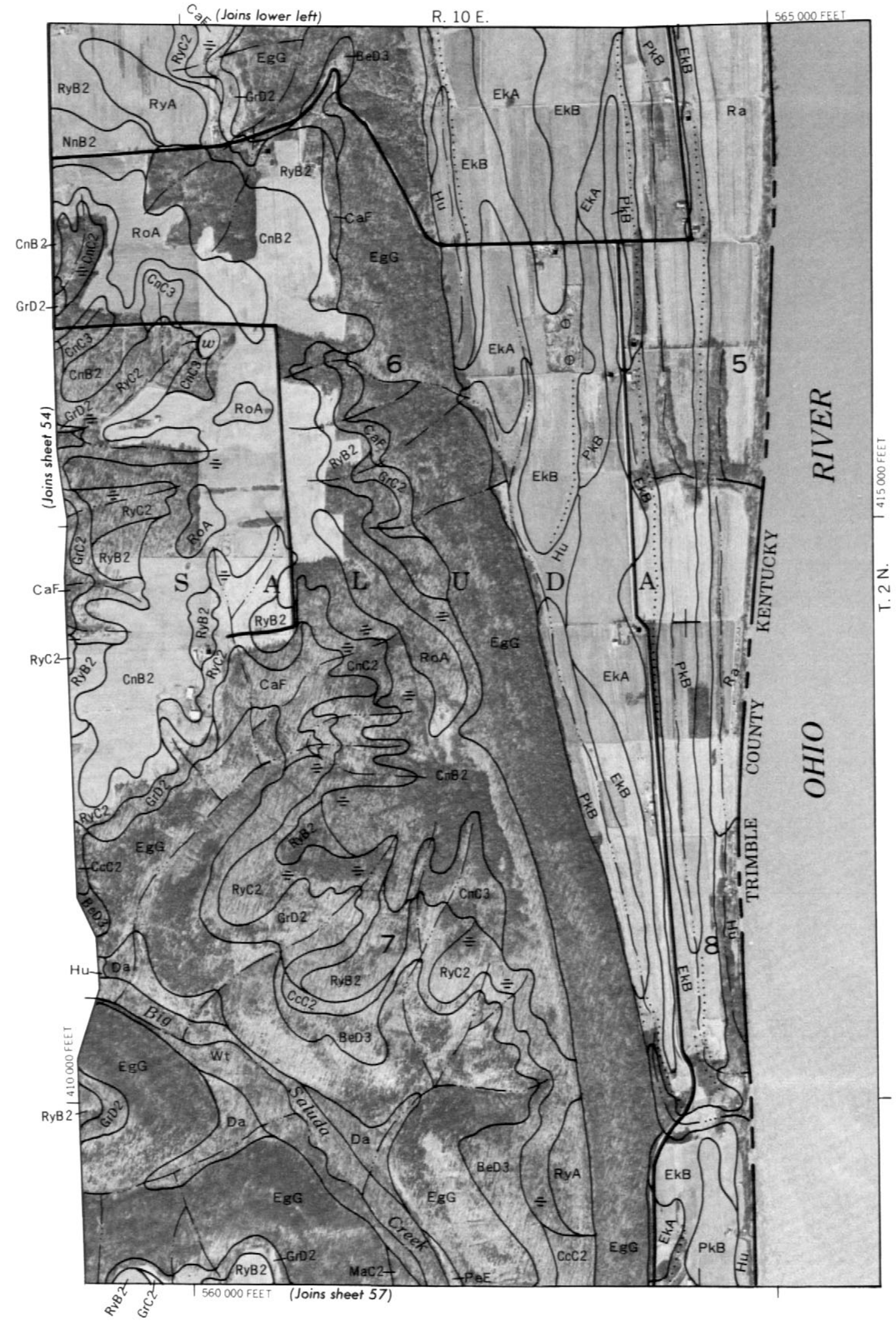

49
N
1 Mile
5 000 Feet
0
0
Scale 1:15 840
¼
1 000
2 000
½
3 000
¾
4 000
5 000
1


50
N
1 Mile
5 000 Feet
Scale 1:15 840
0
¼
½
¾
1 000
2 000
3 000
4 000
5 000
(Joins sheet 47)
(Joins sheet 51)
(Joins sheet 53)
R. 9 E.
T. 3 N.
540 000 FEET
525 000 FEET
425 000 FEET
420 000 FEET
SCOTT COUNTY
HANOVER
SALUDA
Woods Fork
356
30
29
28
31
32
33
Chelsea
AvA
RoA
Co
CnB2
CnC2
CnC3
DeB2
DeC2
DeC3
JnB2
JnC2
JnC3
BnD2
BnD3
BnE
TrD2
TtD3
PkB
Wt
Ho
Ha
RoB2
AvB2
w

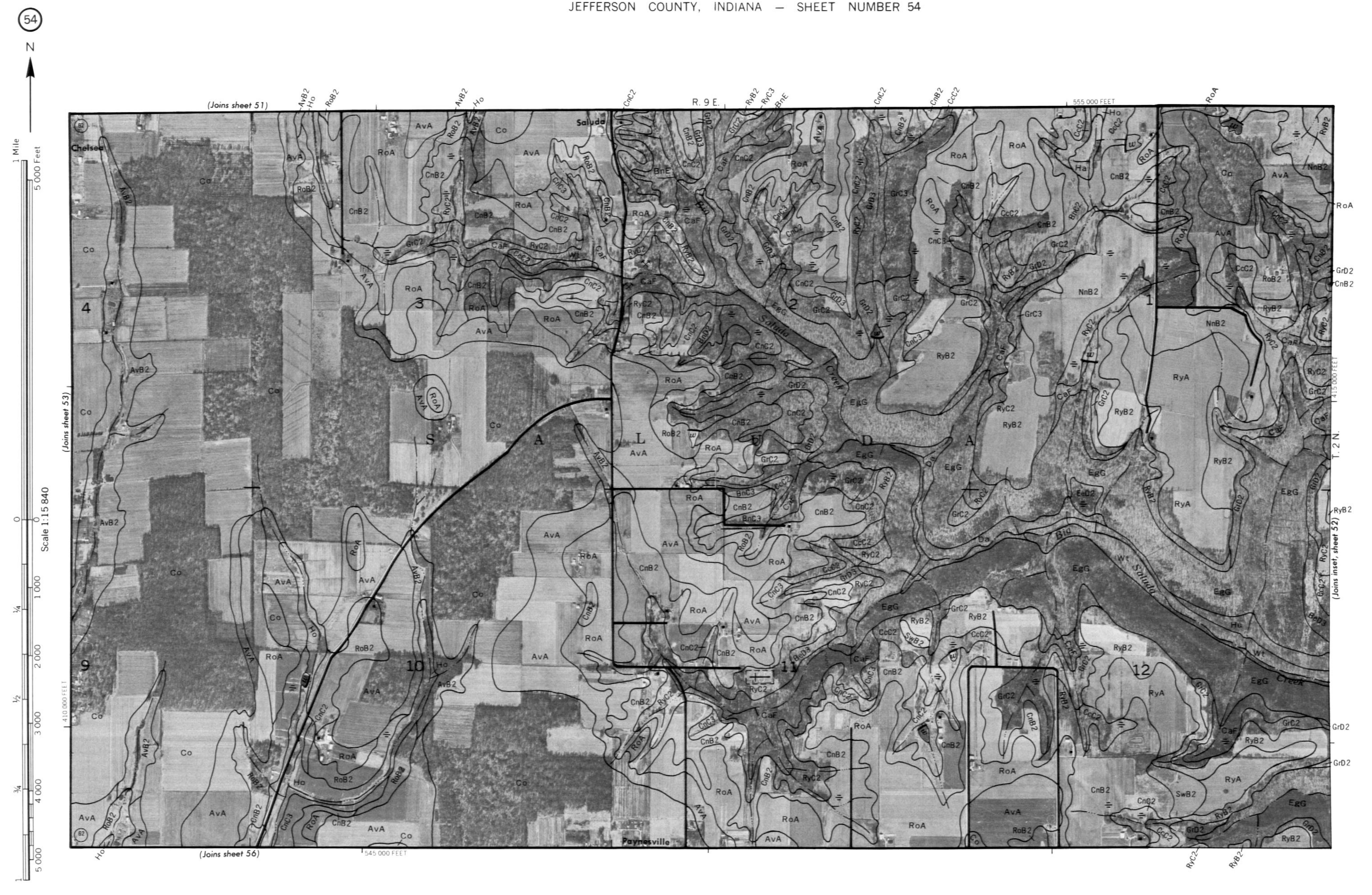

51
N
(Joins sheet 48)
(Joins sheet 50)
(Joins sheet 52)
(Joins sheet 54)
R. 9 E.
T. 3 N.
545 000 FEET
555 000 FEET
425 000 FEET
420 000 FEET
H A N O V E R
S A L U D A
Chelsea
Saluda
25
26
27
28
33
34
35
36
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000


N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 49)
R. 10 E.
565 000 FEET
425 000 FEET
420 000 FEET
560 000 FEET
T. 3 N.
(Joins sheet 51)
(Joins upper right)
OHIO
RIVER
TRIMBLE
COUNTY
KENTUCKY
S A L U D A
Lee
Creek
30
31
32

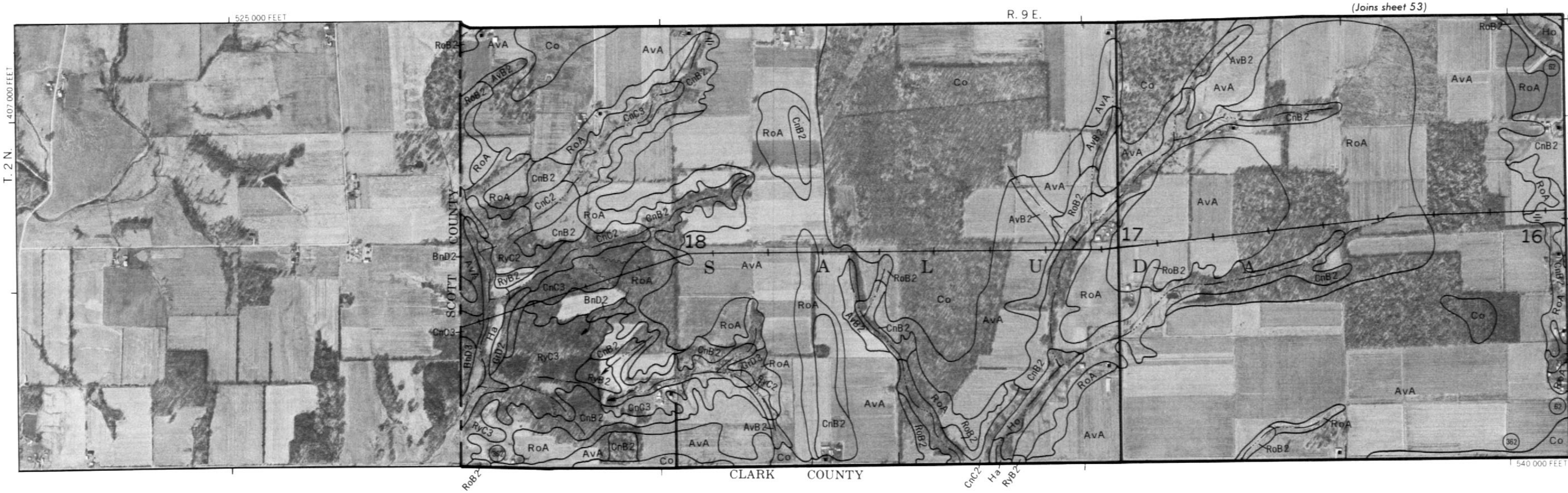
INSET


(Joins lower left)
R. 10 E.
565 000 FEET
415 000 FEET
410 000 FEET
560 000 FEET
T. 2 N.
(Joins sheet 54)
(Joins sheet 57)
RIVER
OHIO
KENTUCKY
COUNTY
TRIMBLE
S A L U D A
Big
Saluda
Creek
5
6
7
8

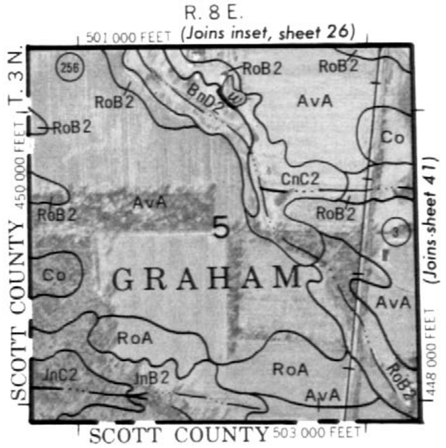
JEFFERSON COUNTY, INDIANA — SHEET NUMBER 53


54
N
(Joins sheet 51)
(Joins sheet 53)
(Joins sheet 56)
(Joins inset, sheet 52)
R. 9 E.
T. 2 N.
555 000 FEET
545 000 FEET
415 000 FEET
410 000 FEET
Scale 1:15 840
1 Mile
5 000 Feet
Chelsea
Saluda
Paynesville
Saluda Creek
Big Saluda Creek
S A L U D A

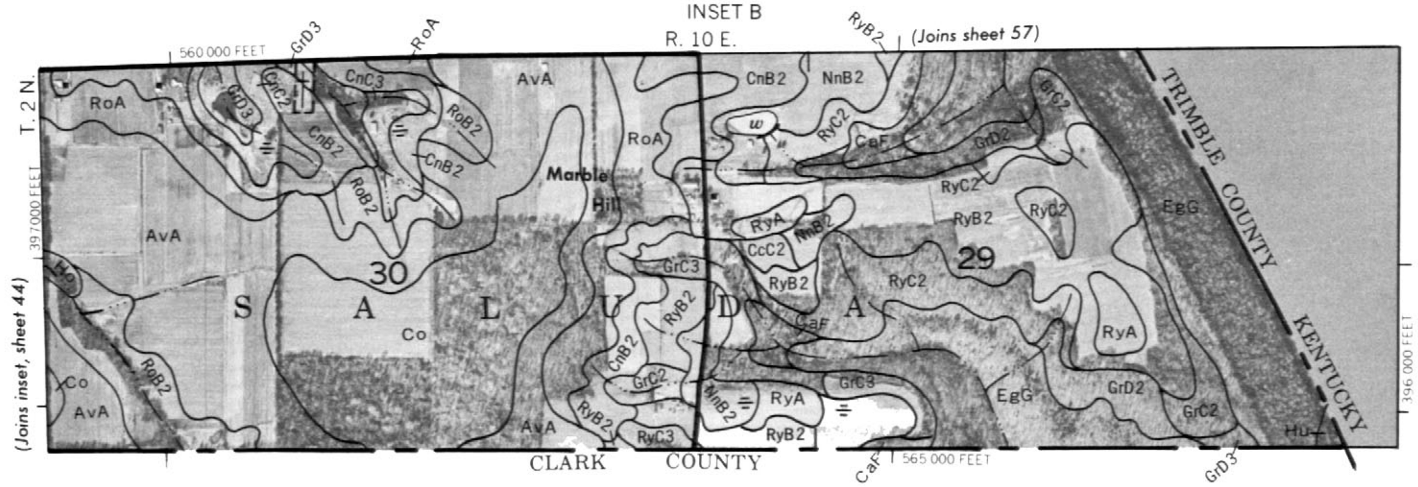
N



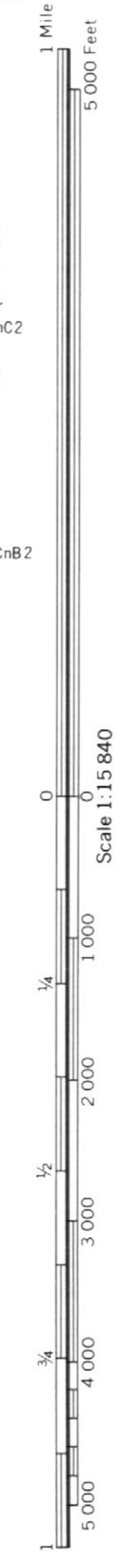
2000 AND 5000-FOOT GRID TICKS



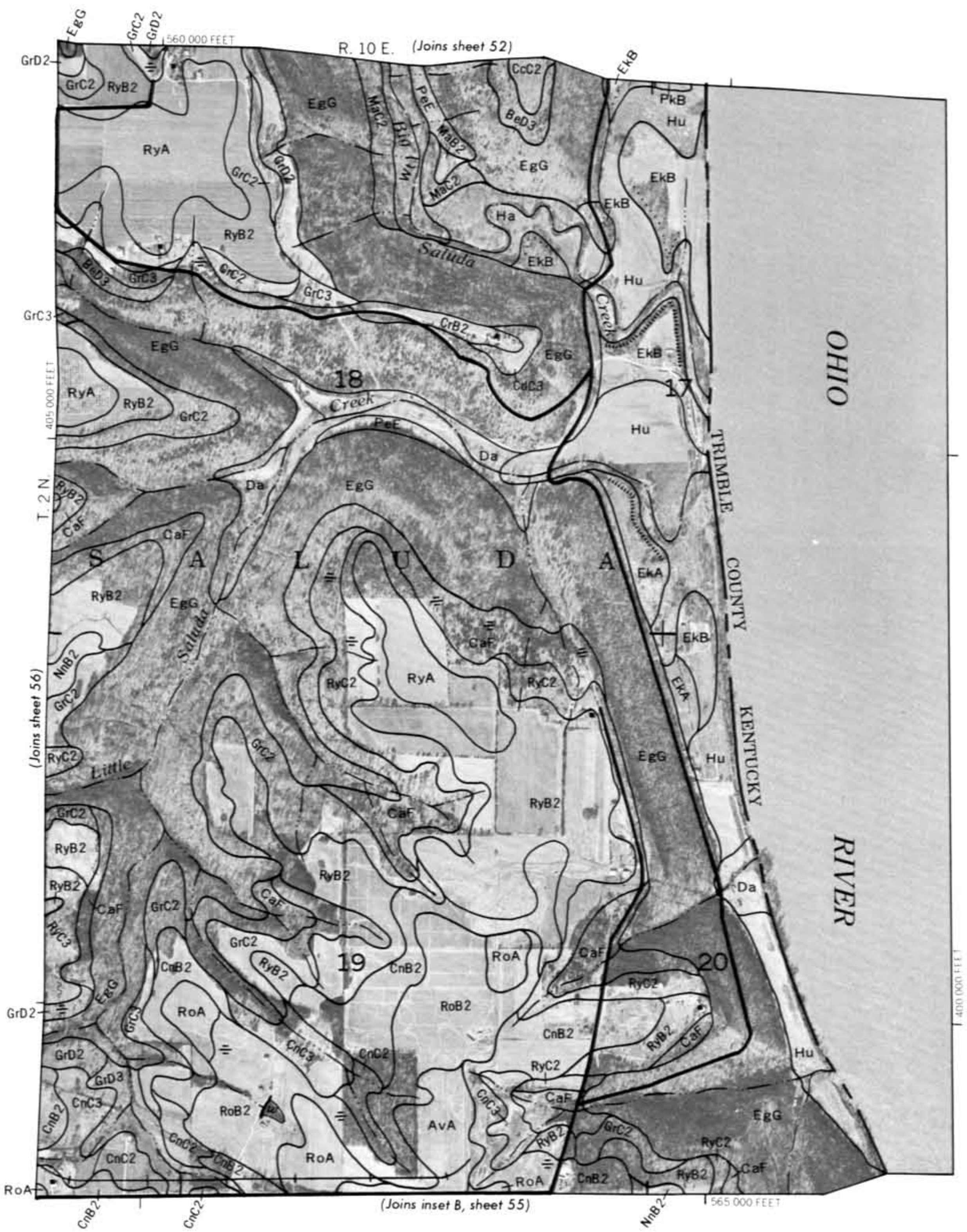
2000 FOOT GRID TICKS



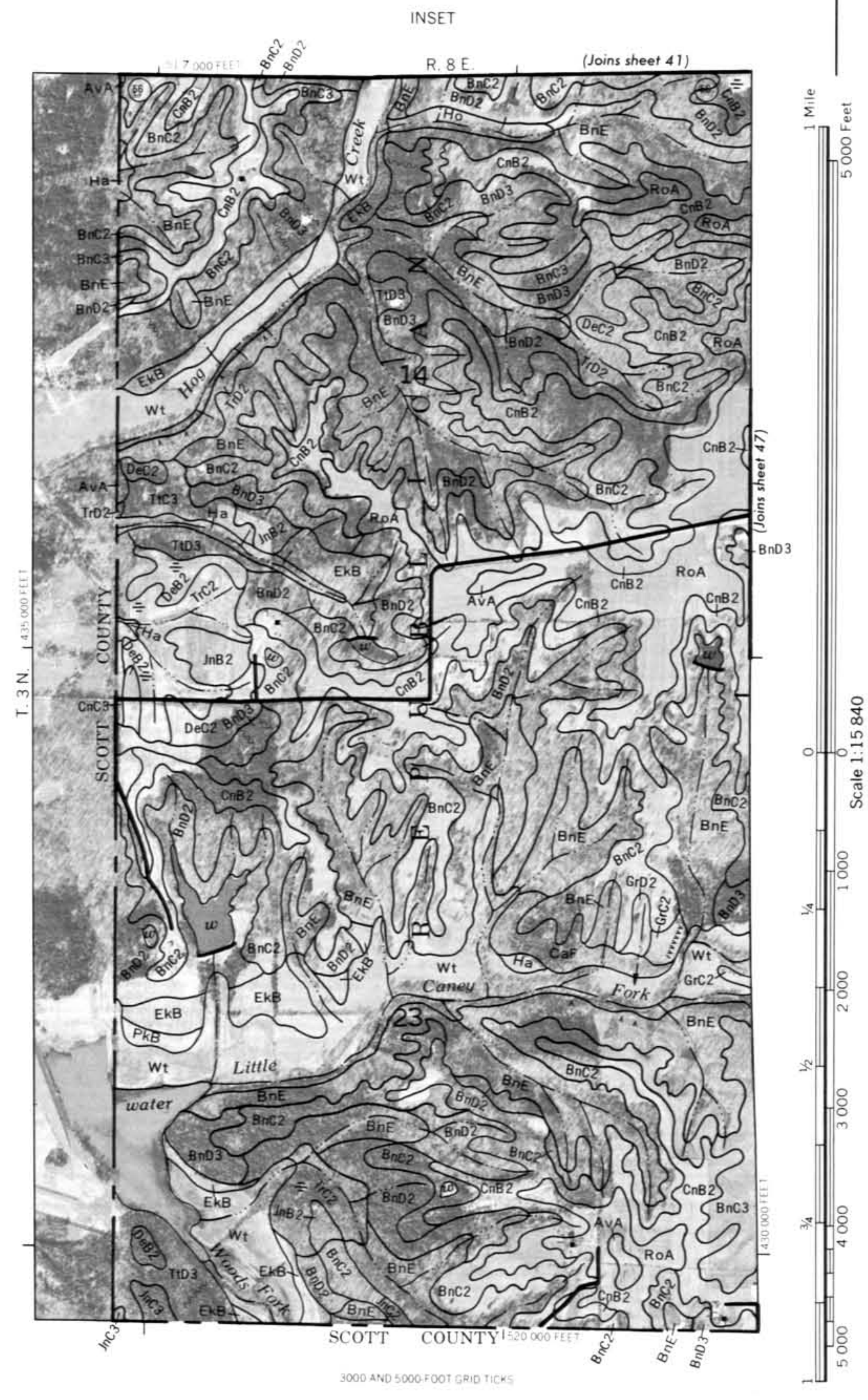
1000 AND 5000-FOOT GRID TICKS



JEFFERSON COUNTY, INDIANA — SHEET NUMBER 56


R. 10 E.
(Joins sheet 52)
(Joins sheet 56)
(Joins inset B, sheet 55)
T. 2 N.
SALUDA
OHIO RIVER
TRIMBLE COUNTY KENTUCKY
Saluda Creek
Little Saluda
18
17
19
20

INSET


R. 8 E.
(Joins sheet 41)
(Joins sheet 47)
T. 3 N.
SCOTT COUNTY
Hog Creek
Caney Fork
Little Caney
Woods Fork
14
23
3000 AND 5000-FOOT GRID TICKS
Scale 1:15 840
1 Mile